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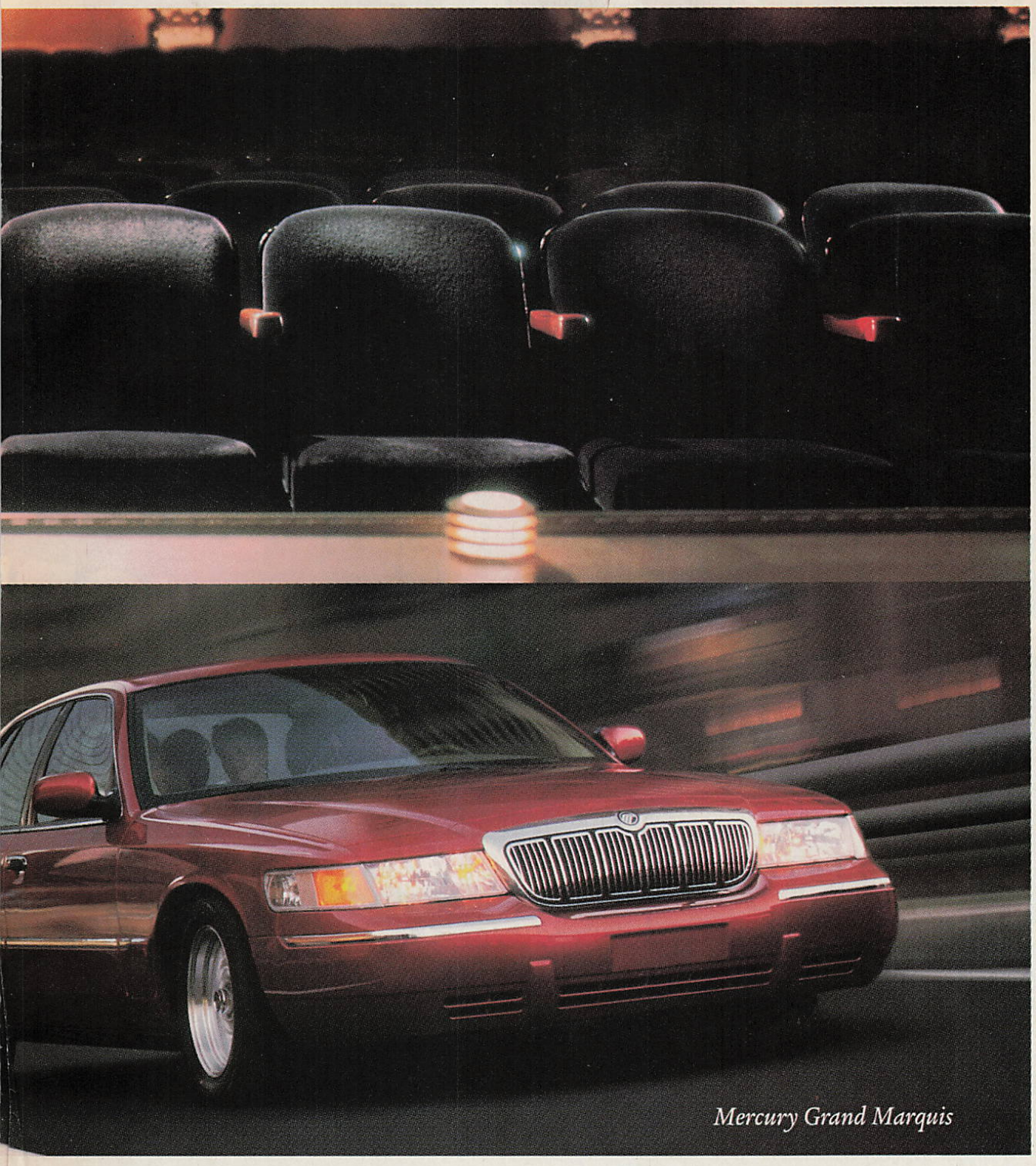

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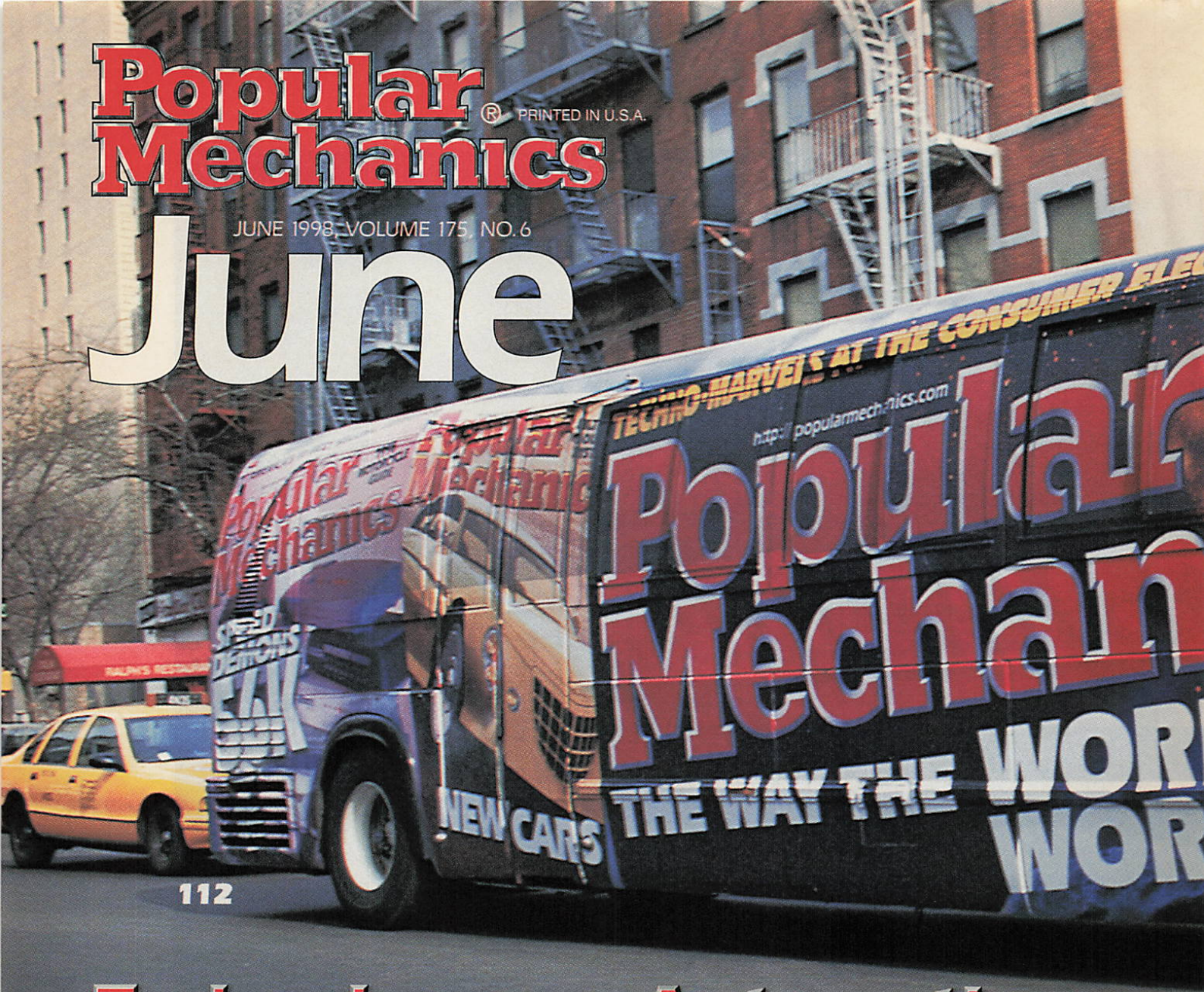
JUNE 1998, VOLUME 175, NO. 6

June



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COVER PHOTO BY BARRY BLACKMAN
BACKGROUND PHOTO BY CLIFF GROMER

Editor's Notes

Speed And Technology

It starts with a question

as old as humankind itself: Who's faster? It may have been asked when the second man was born. It was certainly asked the first time there were more than two cars in the same place at the same time. Now that there are two race series in town, CART (Championship Auto Racing Teams) and IRL (Indy Racing League), both with similar-looking race machines, it's only natural that the age-old question surfaces once again. We've got the answer in the article that begins on page 92. No, I'm not telling. You have to read the article. . . . **The warnings are flying** fast and furious. Every day, TV news shows, newspapers, magazines and magazine TV shows such as "60 Minutes" contain stories about America's vulnerability to an attack by terrorists using weapons of mass destruction. We hear about the United Nations inspectors searching Iraq for Saddam Hussein's weapons of mass destruction. We almost went to war with Iraq a few months ago over weapons of mass destruction.

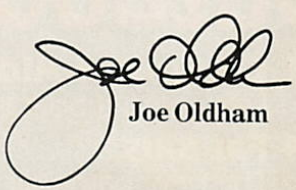
Auto department staffers Don Chaikin, Mike Allen and Scott Oldham give Robbie Buhl a much-needed hand.

Tobey Grumet

Rebecca Day

Kim Komando

Weapons of mass destruction? Until recently, I thought that meant nuclear bombs and missiles. Now, however, that definition has changed. Weapons of mass destruction can be nuclear. Or they can be gases mixed into the air you breathe. Or perhaps diseases spread by microscopic organisms let loose amongst us. Today, weapons of mass destruction can be nuclear, chemical or biological in nature. Some are relatively easy to obtain and they can kill huge numbers of people in very short periods of time. It's a frightening scenario. Even more frightening, there doesn't seem to be much we can do about it if some crazed terrorist fanatic decides to unleash poison gas or anthrax in a crowded subway or office building. Just ask the people of Tokyo. But as awareness of these weapons of mass destruction grows, so, too, does our readiness to guard against and prevent an attack. Start by reading this month's chilling cover article by Contributing Editor Cliff Gromer and Science Editor Jim Wilson on page 80. . . . **Regular readers will notice** that we not only changed our look last month, we also changed the name of a couple of our editorial departments. Our Science/Technology department became, simply, the Science department. And our Electronics department became the Technology department. The change was dictated largely by the changing world around us. In the past two years, computers and telecommunications have become the world of technology. Even on Wall Street, the technology stocks are Intel, Microsoft, Hewlett-Packard and Compaq. So we've changed our nomenclature as well. Also changing is our cast of characters covering this fast-breaking field. Our Technology department is headed up these days by Tobey Grumet, who came to us from *Wideband*, a technology trade paper. Rebecca Day has been a contributor to POPULAR MECHANICS for several years. She now formalizes her relationship with us by becoming a Contributing Editor. Our newest technology writer is Kim Komando. Komando is the weekly technology columnist for the *Los Angeles Times*, hosts a weekly computer talk-radio show heard on more than 190 stations nationwide, has a Web site (www.komando.com) and regularly appears as a computer expert on television. Now you can find her every month in the pages of POPULAR MECHANICS. Till next time.



Joe Oldham

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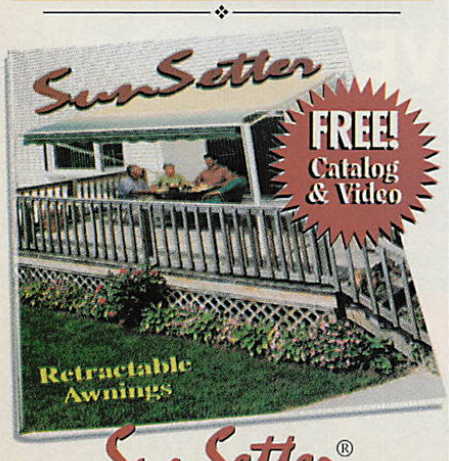

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Cordless radar detector test
May 1997

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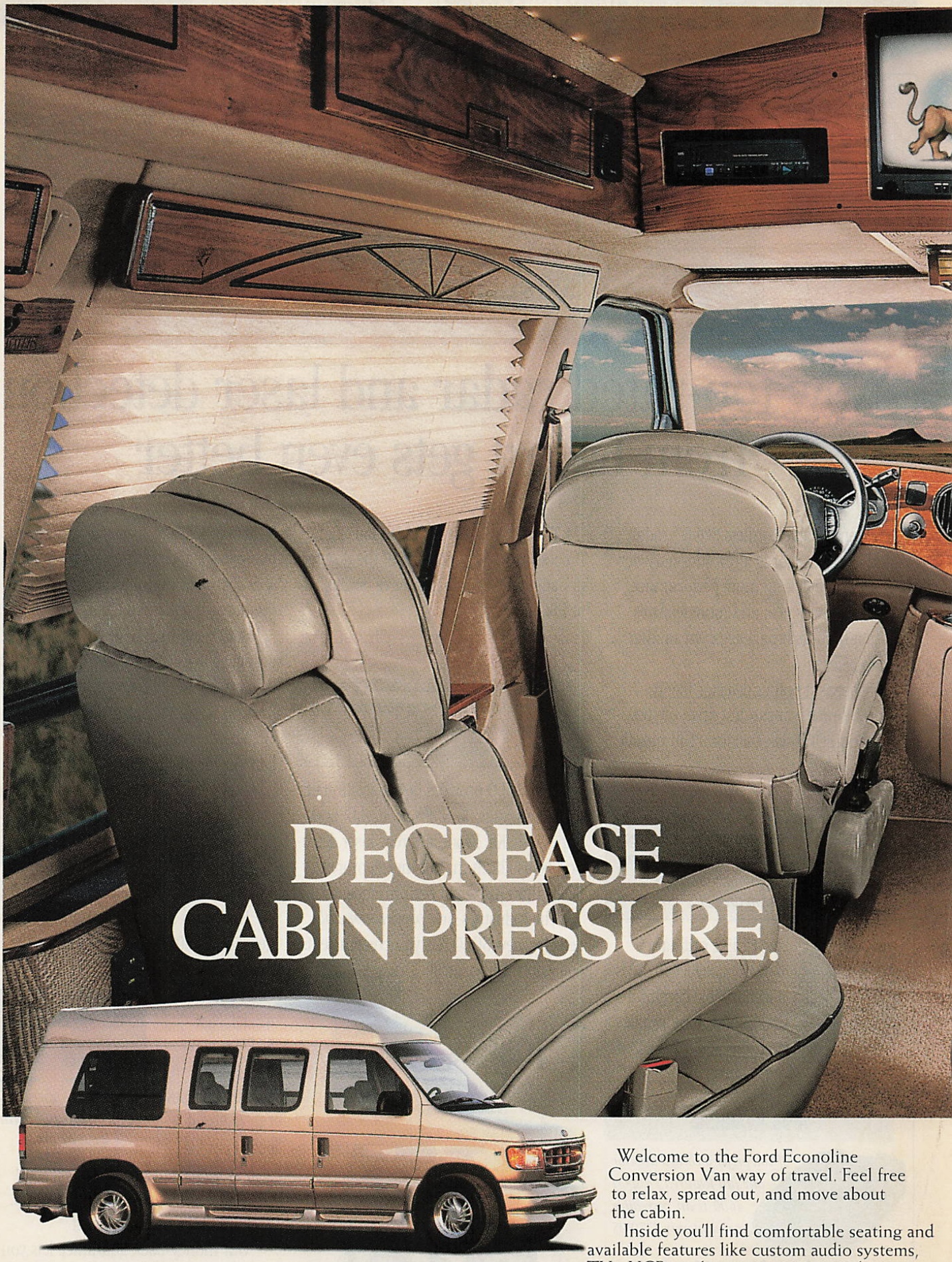

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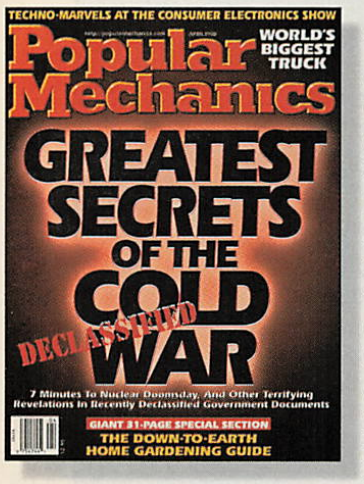
Letters

Declassifying Secrets


TECHNO-MARVELS AT THE CONSUMER ELECTRONICS SHOW
Popular Mechanics
WORLD'S BIGGEST TRUCK
GREATEST SECRETS OF THE COLD WAR
DECLASSIFIED
7 Minutes To Nuclear Doomsday, And Other Terrifying Revelations In Recently Declassified Government Documents
GIANT 31-PAGE SPECIAL SECTION
THE DOWN-TO-EARTH HOME GARDENING GUIDE

Your excellent (and all-too-short) article confirms the bumper sticker that reads: "I love my country, but I fear my government." After reading this piece I can only wonder what they're doing now and what kind of declassified documents I'll be reading about in your magazine 30 years from now.

WAYNE NAUMAN
LANCASTER, PA

I was really riled by the mocking tone in your article. It sounded like you thought the Cold War was just a game of cowboys and Indians. If you've ever read anything by Communism's cofounder, Karl Marx—who said his principle aim was to dethrone God and destroy capitalism—you would see that the "evil empire" was, and is, very real. Please don't mock the seriousness of that terrible time.

BRENDAN WICKE
VIA INTERNET

It came as no surprise to many of us that our intelligence mavens grossly overstated Soviet military might. That made it a lot easier to get bigger and bigger bucks from Congress to feed the Pentagon's never-ending appetite for more weapons.

HERB MOSHER
MIAMI LAKES, FL

For The Birds

I'm worried about that "Most Powerful Magnet" in your March issue. Migrating wildlife have a sense of north (like a built-in compass). If this magnet is 900,000 times stronger than the north pole, what happens to these animals? Will it flip their built-in compass? I hope there is a good purpose or use for this magnet, other than just being able to build it.

TOM VELENCEI
DOVER, NJ

According to a lab spokesman, scientists at the Massachusetts Institute of Technology looked into this situation and found that the magnetic field is so well contained that it had no effect on homing pigeons.
—Jim Wilson

Saddle Up

Your profile of cowboy action shooting was a great look at how the kids who never stopped playing cowboy do it in the '90s. The entire family gets involved. Adults and kids alike learn about how to have fun with 1880s-era pistols, rifles and shotguns.

JOE "SUNRIDER" SMALDINO
GLENDORA, CA

I really enjoyed your article on cowboy action shooting. I usually come in last when I participate, but I have a great time anyway. Half the fun is working on my period outfit. You'll never find a friendlier or safer group of folks, regardless of where you shoot.

DAVID BENNETT
VIA INTERNET

Letters are subject to editing for length, style and format.

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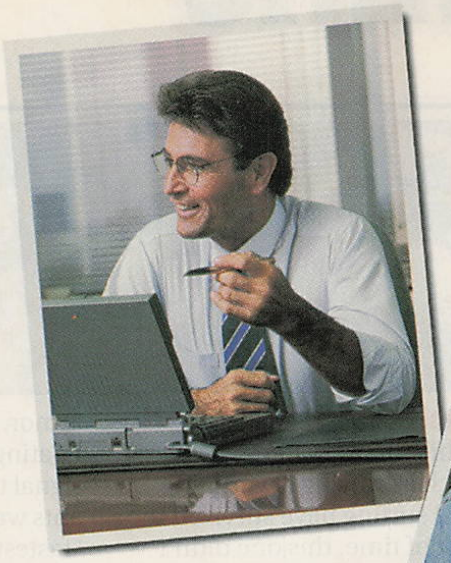
Reader Project Of The Month

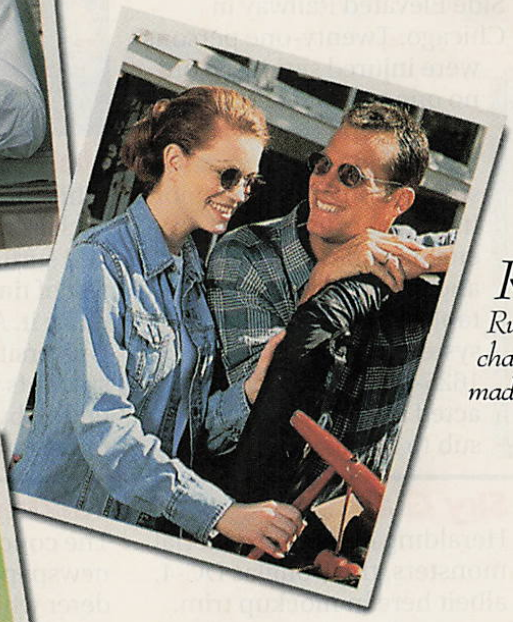
I needed a light but strong boat that I could easily trailer to lakes near me in the Phoenix area. But I didn't want just any aluminum boat. I wanted one with style, one that didn't look like a fishing boat. So I got out an old POPULAR MECHANICS book, *Build A Boat For Pleasure Or Profit.* I combined the Banta and Skipper plans to build this 14-ft. outboard runabout. I made some adjustments to the frame members, increased the size of the hull and raised the sheer line. The skin is marine plywood instead of the batten-seam plan specified for Skipper, to save considerable time and expense. People are amazed that the boat is made from wood, and it's the strongest I've ever built.

GRANT F. HESS
FOUNTAIN HILLS, AZ

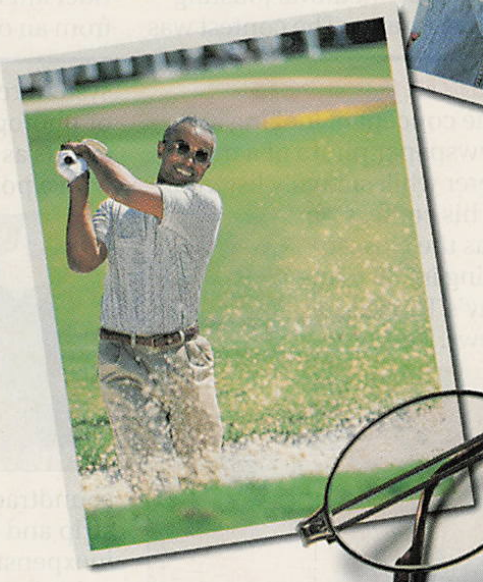
If your project is chosen as Reader Project Of The Month, you will receive a Stanley Home Improvement Kit, complete with hand and decorating tools, and an electric stapler/nailer, valued at more than $200. For your project to be considered, please send a clear, color photo and brief description to: Reader Project Of The Month, Popular Mechanics, 224 W. 57th St., New York, NY 10019.



George Evans, successful stockbroker, made the analysis, then made the change.



Richard and Tina Runyan made the change, before they made the big move.



Jeff Wood, father of three and weekend pro, made the change last year.

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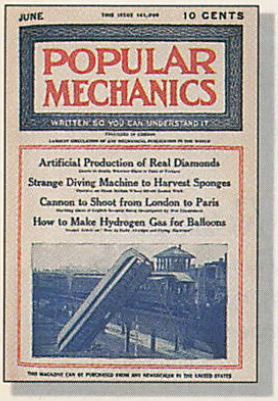
Time Machine

90 Years Ago: June 1908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How to Make Hydrogen Gas for Balloons

Fright Train

Train wrecks make for great photos, and this issue's cover shows a wreck on the South Side Elevated Railway in Chicago. Twenty-one persons were injured seriously, but no one was killed. Elsewhere in the issue is a 2-man sub designed to gather sponges on the ocean floor. It used oars in place of an engine and was raised and lowered by a water-tank/compressed-air system. A releasable 1625-pound lead ballast acted as insurance for the sub to rise to the surface.

Unhorsing Around

While many watersports, such as rowing, swimming and surfing have survived the test of time, this one didn't make it. Aquatic tilting by University of Pennsylvania students was inspired, no doubt, by medieval jousting tournaments. The contest was held under direction of the swimming instructor. The students, clad in lightweight swimsuits instead of heavy armor, were mounted on two floating horses. Upon the signal to begin, the combatants went at each other at the "fastest possible speed," while wielding padded lances. The horses were delicately balanced and would unseat a rider after even a slight thrust from an opponent's lance.

60 Years Ago: June 1938

Sky Giants

Heralding in the age of aerial monsters, the Douglas DC-4, albeit here in mockup trim, was nearly three times the size of giants of the airways then in service. The DC-4's four radial engines produced some 6000 hp. The plane could carry a full load of 42 passengers, plus a crew of five and 3½ tons of mail at a top speed of about 237 mph at 8000 ft. Cruising range was put at 2200 miles. A first in large-plane construction was the use of flat flush-type rivets in the skin.

Talking Papers

The concept of looking at a newspaper photo of a murderer while actually listening to his confession was the closest thing in '38 to today's TV evening news. The system required the reporter or photographer to record events as a film soundtrack with a portable recorder. Back at the paper, the film was developed and printed on the page or in the margin as wavy lines. The reader would cut and paste the soundtrack in one continuous strip and run it through an inexpensive player attached to his loudspeaker. The same technique would also make "talking comics."

30 Years Ago: June 1968

'69 CARS—How Different Will They Be? Page 64
POPULAR MECHANICS
JUNE 1968
50 CENTS
BUILD THIS ONE-MAN SUB
Page 90
Bright Summer IDEAS
Floating Lawn Chair Page 130
Deluxe Barbecue Bar Page 134
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America's Supersecret Spy Plane That Outflies the U-2
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Select an Electric Motor
Pick the Right Propeller
Buy Your First Motorcycle
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Troubleshoot Your Outboard
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Scuba Sub

It was "Voyage To The Bottom Of Silver Springs," as a PM editor reported on his adventure piloting a $250 homebuilt one-man sports sub. It worked surprisingly well. The semi-dry sub kept the upper part of his body dry at any depth in the bubble conning tower. Adjusting the volume of air trapped inside the sub controlled ascent and descent without power. But small battery-operated trolling motors were able to raise and lower the sub with the air valve set to the neutral position.

Spy 'N' Fly

PM presented three Blackbirds all in a row—the A-11, YF-12 and SR-71 super-secret U.S. Air Force spyplanes (actually all versions of the same design). After reviewing the performance parameters of the aircraft and revealing where they were based, PM got to the heart of the issue—what these planes were doing then and what their mission was. While the Air Force allowed PM to interview YF-12 pilots, they maintained a cloak of secrecy over the mission and put the kibosh on requests to talk to the SR-71 jocks. So the mystery remained unsolved. PM

TOP SECRET
AMERICA'S SUPERSECRET SPY PLANE
By KEVIN V. BROWN
The Air Force's Mach-3 jet first flew nearly five years ago, but the mystery of its mission lingers on

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Environment • Medicine • Military
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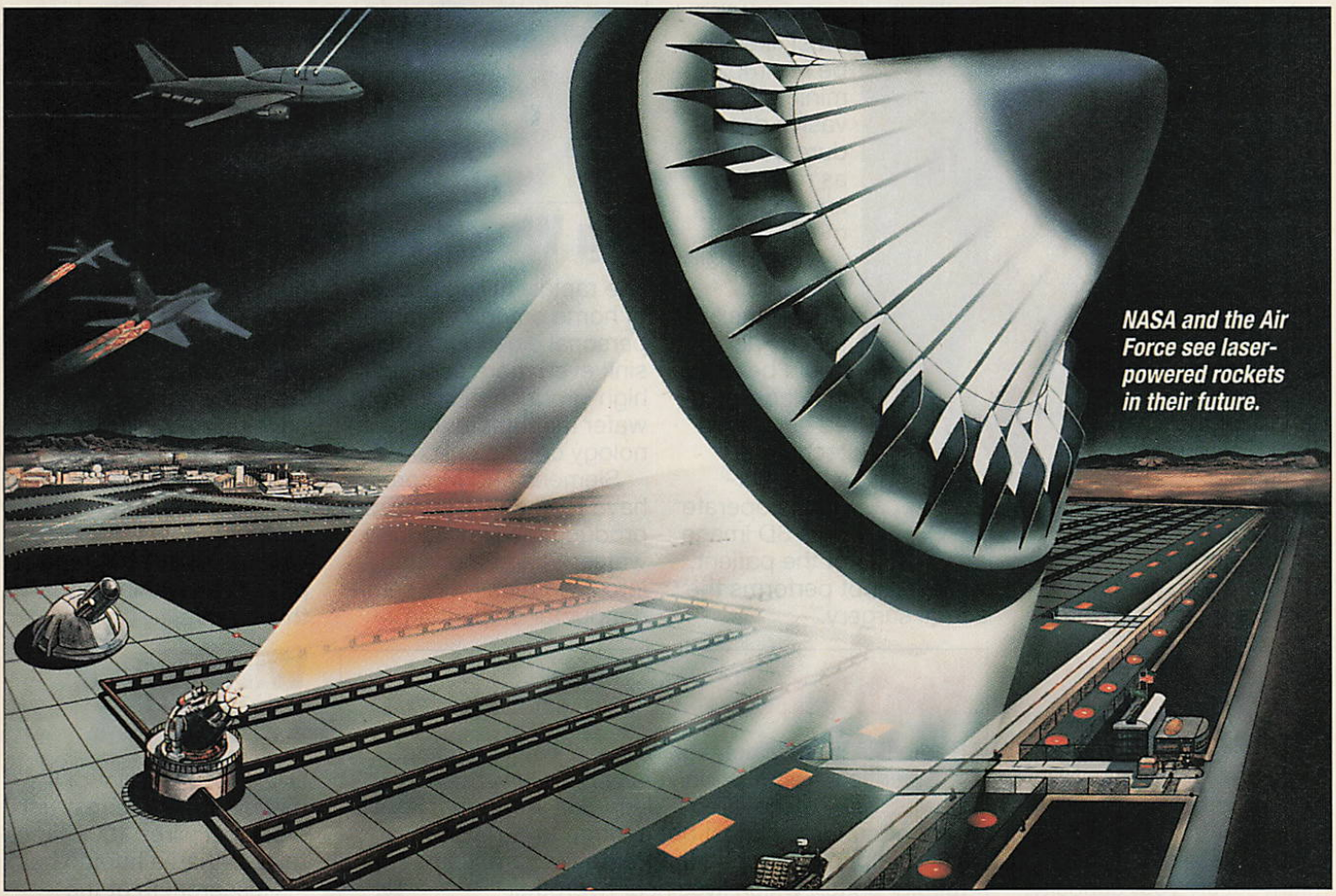


NASA and the Air Force see laser-powered rockets in their future.

Riding Light Beams To Space

A radical new propulsion system could make future space launches look more like laser shows than fireworks displays. Using a ground-based 10kw laser, scientists at White Sands Missile Range, in New Mexico, have shot pie-plate-size capsules up to 100 ft. aloft.

"It's comparable to what the Wright brothers did at Kitty Hawk," says Jonathan Campbell, of NASA's beamed energy program. "We've just demonstrated that the principle works. Nobody thought it could be done."

Tests were performed by zapping 20 laser pulses per second at the bottoms of 8-in.-tall, 2-ounce, cone-shaped capsules. Some were made of aluminum, others aluminum-lithium and titanium. When the concentrated beam of light hits the highly reflective base of the capsule, the air around it gets extremely hot and expands explosively, providing the thrust. Amid popping that sounds like a string of firecrackers, the capsule zooms upward, then silently falls back. A technician catches the capsule with a fishnet.

Laser propulsion could have its first practical application boosting lightweight instrument packages up to 100 miles.

Even with full funding, researchers say it would take at least five years for the maiden launch. So far, NASA and the Air Force have spent less than $1 million on the joint project.

Despite these modest beginnings, the future looks bright. Leik Myrabo, a researcher with the Rensselaer Polytechnic Institute, in New York, envisions not only spacecraft but laser-propelled airplanes.

Editor: Jim Wilson
Reporters: Stefano Coledan, Brad Dunn, Scott Gourley, Richard Schrader

June Highlights

Miniature Surgical Robot—Cutting with instruments could speed recovery.

- **Air Stops Water**—Inflatable dam holds back floods as well as steel and concrete.
- **Artificial Blood For Dogs**—Disease-free substitute promises to save humans too.

DEPARTMENT OF DEFENSE ILLUSTRATION

Technology Watch

Robot Is A Real Cut-Up

A robot that could revolutionize several forms of surgery—and speed patient recovery—has won Akhil Madhani this year's $30,000 Lemelson/Massachusetts Institute of Technology Student Prize.

Dubbed the Black Falcon, it performs complicated but repetitive surgical tasks, like suturing blood vessels and tying knots.

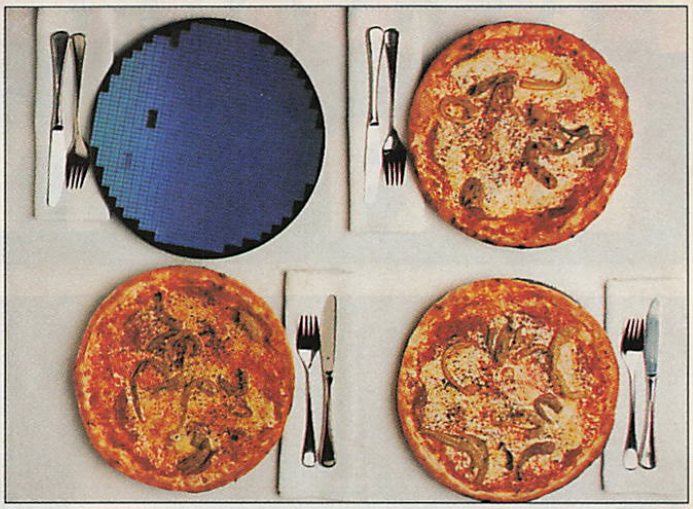
There is no danger of the Black Falcon putting surgeons out of business. It can't work without them. A surgeon controls the robot, watching its progress on a monitor several feet away. The robot moves exactly the way it's commanded, and a computer filters out any tremors in the surgeon's hand—making more precise cuts than if the tools were held by hand.

The robot's first applications will most likely be in simple, minimally invasive procedures, such as repairing knee ligaments and removing gall bladders.

Eventually Black Falcon could be used in image-guided surgery, a technique where surgeons operate on a 3D image of the patient, while a robot performs the actual surgery.

Madhani's Black Falcon has a steadier hand than humans.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY



SIEMENS

Big Wafer Packs More Chips

The rapidly falling prices of home computers and personal electronics could sink even more as a new high-production silicon wafer manufacturing technology comes online.

Siemens and Motorola have teamed up to mass-produce the first 12-in. wafer. It can be divided into 2½ times more semiconductor chips than current 8-in. wafers. Dubbed the Semiconductor 300, the joint venture will be based in Dresden, Germany, and aims to have pizza-sized wafers in production by 2000.

The new wafers promise to reduce manufacturing costs by 30%, which could lead to lower price tags within about three years.

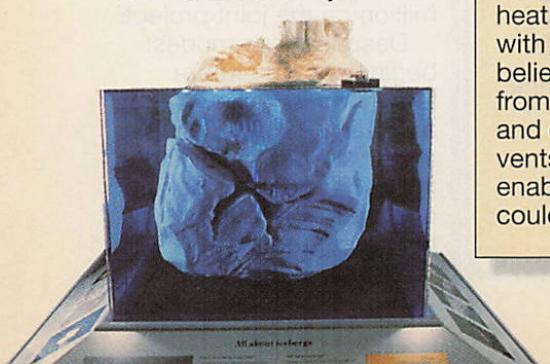
Antarctic Adventures

If you are interested in Antarctica but have cold feet about going to the south pole, a new exhibit might satisfy your curiosity.

Antarctica, a 6000-sq.-ft. traveling exhibition currently at Nauticus, The National Maritime Center in Norfolk, Va., offers an exciting glimpse of the driest, coldest and windiest place on Earth. Complete with penguin dioramas, photos and video programs, *Antarctica* also exhibits an iceberg model (below), meteorites and a mummified seal.

The exhibition is currently touring museums across the country.

SCIENCE MUSEUM OF MINNESOTA



Earth's Hottest Animal

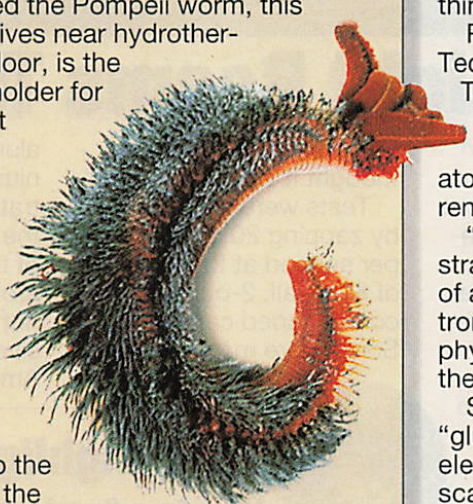
Some like it hot. Then again, some like it scalding.

Scientists from the University of Delaware, in Lewes, have discovered a deep-sea worm that lives in temperatures almost hot enough to boil water.

Appropriately named the Pompeii worm, this tubular critter, which lives near hydrothermal vents on the seafloor, is the planet's new record-holder for the most heat-tolerant multicelled creature.

More unusual than the worm is its fondness for temperature extremes. Though it is only 4 in. long, it likes to keep its tail in 176° F temperatures near vents and its head in chillier 72° F waters.

A crucial element to the worm's ability to take the heat is its symbiotic relationship with strange, fuzzy bacteria (see photo). Researchers believe the bacteria insulate the worm and protect it from exposure to the hydrogen sulfide, lead, cadmium and other heavy metals that spew from seafloor vents. Scientists conjecture that the enzymes that enable the bacteria to detoxify the heavy metals could one day be used to clean up toxic waste sites.



UNIVERSITY OF DELAWARE/CRAIG G. CARY (ABOVE)

Wire Made From DNA

DNA, the blueprint of life, can be used to construct electrical wires 1000 times thinner than a human hair.

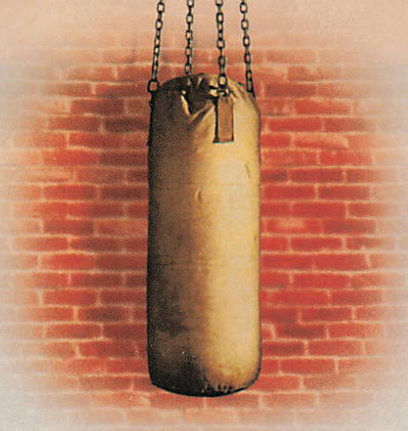
Researchers at the Technion-Israel Institute of Technology, in Haifa, have invented a way to use DNA to bind silver atoms to produce a current-carrying wire.

"This is the first demonstration of self-assembly of any functioning electronic component," says physicist Uri Sivan, one of the project's leaders.

Strands of DNA are "glued" to two gold electrodes and act as a scaffold for collecting silver ions. The silver atoms connect and form a wire only 100 nanometers thick.

The development is a critical step in nanocircuit technology and opens the door for a giant step in downsizing electronics.

(More Technology Watch on page 18)



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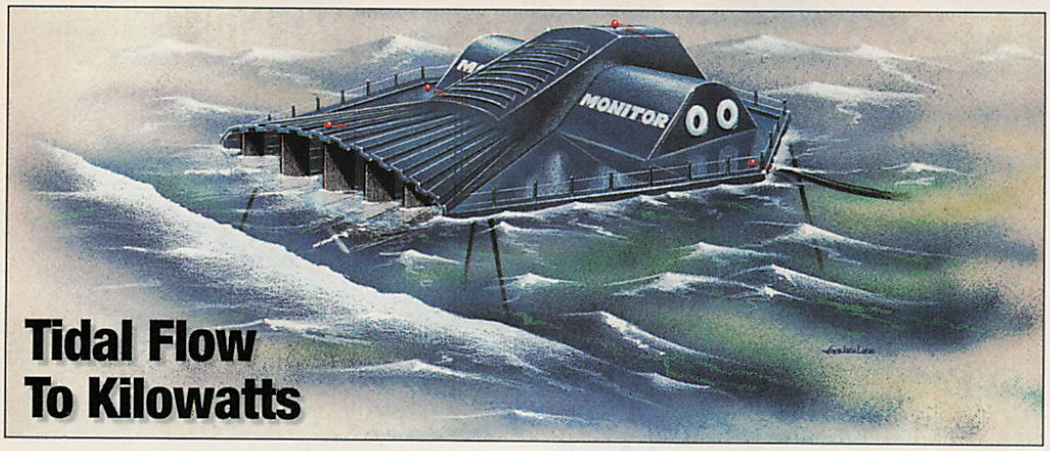


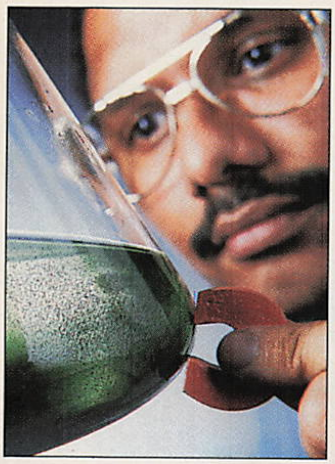
DEMI-TEK

Tidal Flow To Kilowatts

The Moon's gravitational tug on the oceans has the potential to produce enormous amounts of power. The trick is to tap it.

Monitor, shown above, is a 12 × 20 × 40-ft. polyethylene platform that uses a unique catapulting system to turn Moon power into electric power. Incoming waves force *Monitor* shoreward, stretching the Seaflex cable that anchors it to the seafloor. As the wave crest subsides, the cable returns the platform to its original position. This causes water to rush into the platform's cavernous openings. Inside, the water is channeled in a way that increases its speed. Passing through turbines connected to twin marine generators, *Monitor* can crank out as much as 500kw during incoming tides and stormy weather.

Developer Bob Bishop, president of Demi-Tek, in West Caldwell, N.J., expects the first application to be as a power supply to replace generators on ocean research platforms.



ARGONNE NATIONAL LABORATORY

Draws Waste Like A Magnet

A simpler way of removing metals and radionuclides from wastes has been developed by Argonne National Laboratory.

This new approach uses small magnetic particles with a chemical coating that attracts specific metals, explains developer Luis Nuñez.

Placed in a tank containing a waste solution, the particles attract the target pollutant. They are then removed and the captured pollutants are chemically stripped and in most cases recycled.

Argonne believes the process will attract industrial users because it allows the reuse of compounds that are now being thrown out.

Navy Motor Breaks Record

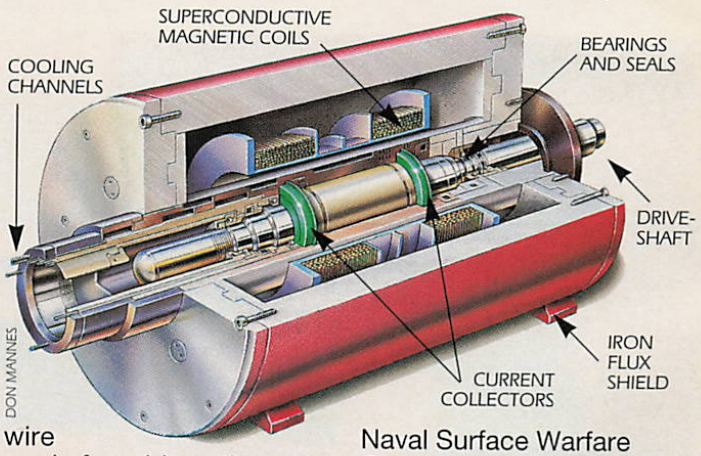
Record-breaking performance has been achieved by an experimental superconducting motor (SCM) being developed by the Navy.

Operating at what is for superconductors the relatively balmy temperature of minus 321°F, the SCM produced 104 hp. The previous record at this temperature was only 5 hp.

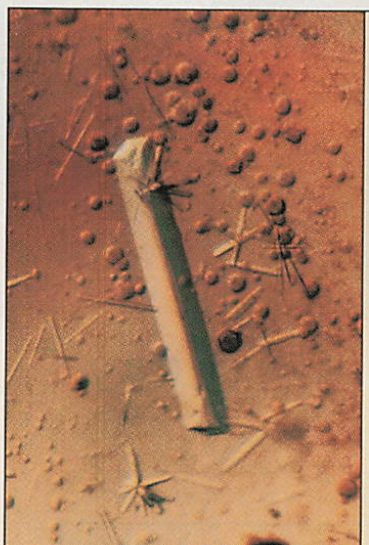
While power outputs as high as 320 hp have been achieved using the same motor, they have required much colder temperatures. These conditions could be achieved only by using expensive liquid neon and helium. Nitrogen is preferred for military applications because it is so plentiful.

The superconducting field magnet for the motor consists of six coils wound with high-temperature superconducting wire made from bismuth, strontium, calcium and copper oxide. Instead of conventional brushes, which would generate heat, the SCM uses sodium potassium liquid metal current collectors.

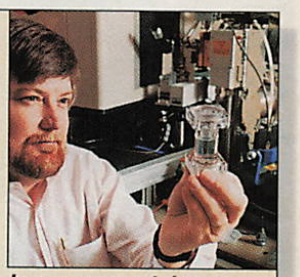
Researchers at the Naval Research Laboratory and Naval Surface Warfare Center believe versions of their SCM will someday be used aboard smaller ships, such as minesweepers.



DON MANNES



Virus Imaged



In space, crystals grow larger than on Earth.

Crystals grown on last summer's *Columbia* space shuttle mission may help cure respiratory syncytial virus (RSV), the most serious infectious disease for infants.

Using these crystals, researchers at New Century Pharmaceuticals, in Huntsville, Ala., have determined the 3D atomic structure of a potential therapeutic antibody.

Currently, there is no vaccine against RSV. Knowing the molecular structure of its antibodies will help researchers develop treatments. And that could save 4000 young lives a year.

NASA

(More Technology Watch on page 22)

DON'T GET STUCK WITH A FLAT.

INTRODUCING GOODYEAR'S NEWEST RUN-FLAT TIRE.

New Goodyear Aquasteel Run-Flat can suffer a major puncture, lose all air pressure and still run up to 50 miles at 55 mph to safety.* But the technological news doesn't end there. Its aquachannels and ultra-tensile steel ply mean Aquasteel also delivers exceptional wet traction and handling. New Aquasteel Run-Flat. Serious technology. Freedom from worry. Only from Goodyear.

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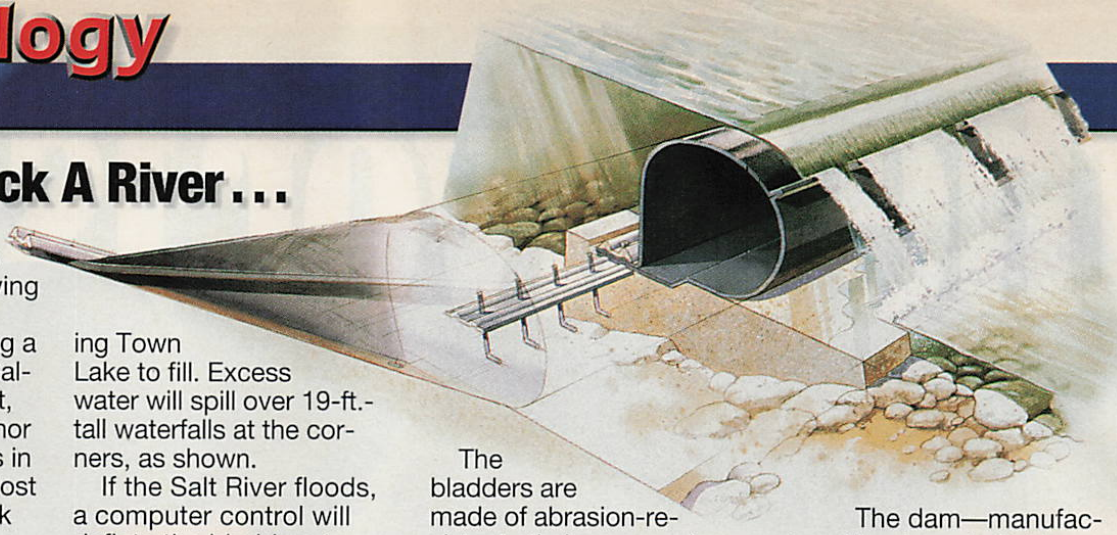
Technology Watch

Air Holds Back A River . . .



BRIDGESTONE ENGINEERED PRODUCTS

The air compressor has found a novel use: blowing up dams.

Instead of constructing a concrete dam, the Rio Salado flood control project, in Tempe, Ariz., will anchor eight 55-ton air bladders in a concrete baseplate. Most of the time the ¾-in.-thick nylon-reinforced rubber dam formed by the bladders will be inflated, allowing Town Lake to fill. Excess water will spill over 19-ft.-tall waterfalls at the corners, as shown.

If the Salt River floods, a computer control will deflate the bladders to maintain the size of the 224-acre lake.

The bladders are made of abrasion-resistant ethylene propylene diene monomer that is warranted for 30 years.

The dam—manufactured by Japan's Bridgestone Corp.—should be ready to "blow up" in 1999.

LIQUID SOD

The frameless dome is rolled out over a field, weighted with water, inflated with warm air, and ready for use in about one hour.

. . . And Holds Up A Dome

Fed up with foul weather delays and cancellations, a British rugby team took a cue from U.S. pro football and covered its playing field with a dome.

No multimillion-dollar structure for the Cardiff Rugby Football Club, though. Instead, two groundskeepers roll out a portable dome and an electric fan. Inflated with warm air, the top of the semitransparent, UV-protected polyethylene dome rises like a hot-air balloon. Water-filled weights keep it on the ground.

Liquid Sod, of Dorset, which markets the dome, says it can span the length of an American football field without internal obstructions. The company says similar domes will be rising over otherwise soggy fields in the United States later this year.

©1997 Kawasaki Motors Corp. U.S.A. Model shown with available accessories. Always wear a helmet, eye protection and proper apparel. Never ride under the influence of drugs or alcohol. Adhere

Carbon Goes Electronic

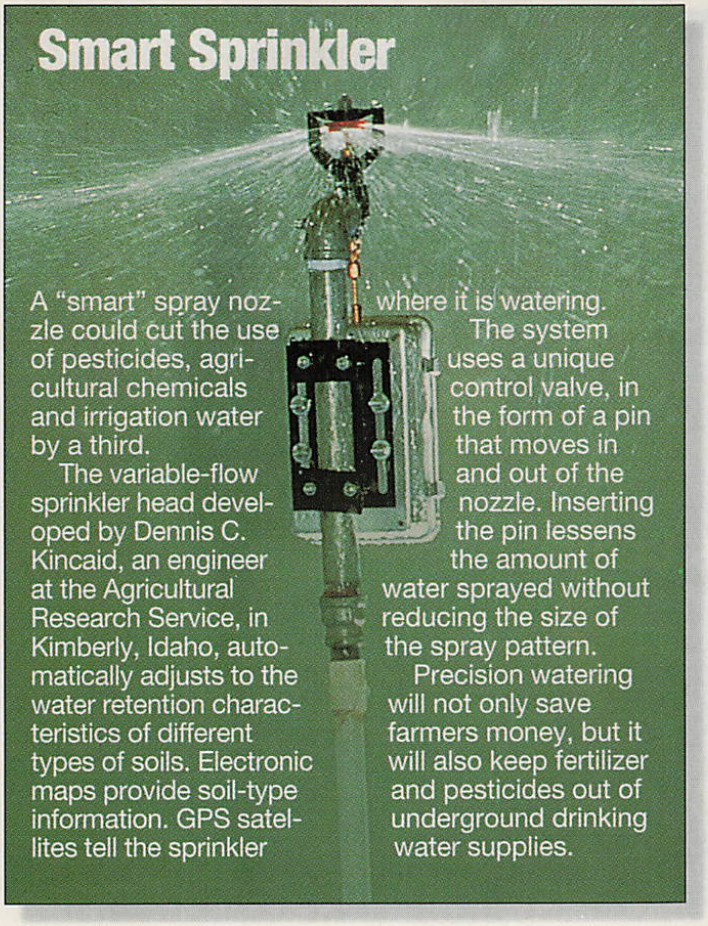
For the first time, researchers have observed semiconducting behavior in carbon composites.

"This means we can use the structural material itself as the electronics. The whole piece is 'smart' and no electrical interconnection is needed," says Deborah Chung, a professor at the State University of New York at Buffalo who made the discovery.

Unlike conventional silicon semiconductors, which are made from different materials, carbon semiconductors derive their electron-flow regulating properties from the alignment of the carbon fibers themselves.

Possible applications include wafer-thin batteries and computers made without discrete "chips."

Smart Sprinkler



A "smart" spray nozzle could cut the use of pesticides, agricultural chemicals and irrigation water by a third.

The variable-flow sprinkler head developed by Dennis C. Kincaid, an engineer at the Agricultural Research Service, in Kimberly, Idaho, automatically adjusts to the water retention characteristics of different types of soils. Electronic maps provide soil-type information. GPS satellites tell the sprinkler where it is watering.

The system uses a unique control valve, in the form of a pin that moves in and out of the nozzle. Inserting the pin lessens the amount of water sprayed without reducing the size of the spray pattern.

Precision watering will not only save farmers money, but it will also keep fertilizer and pesticides out of underground drinking water supplies.

USDA-ARS INFORMATION STAFF

Fiber Carries Laser Punch

A fiberoptic strand the thickness of the lead in a mechanical pencil has transmitted sufficient laser energy to cut through a ½-in. stainless steel plate.

The light, created by a 7.4kw chemical oxygen-iodine laser, was transmitted through 900-micron-dia. fiber for a distance of about 6 ft. in an experiment devised by scientists from the University of Illinois at Urbana Champaign and STI Optronics, of Seattle.

"If we can easily move high-energy light wherever it is needed in a manufacturing environment, the laser would be an efficient commercial tool for metal-cutting and welding," says Capt. Brian Quillen of Kirtland Air Force Base, in New Mexico, where the test was conducted.

MONDAY'S GAINING ON YOU

IT WHINES IN YOUR EARS AND NIPS AT YOUR HEELS

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NASA/BRAD WHITMORE

When Galaxies Collide

Astronomers have captured a preview of Earth's future by looking back in time through the lenses of the Hubble Space Telescope.

Their observation, above, shows the collision of the NGC 4038 and NGC 4039 galaxies, located about 63 million light-years away.

"These spectacular images help us understand how globular star clusters formed," says Francois Schweizer, of the Carnegie Institution of Washington.

Astronomers say our own Milky Way faces a similar fate because it is on a collision course with the Andromeda galaxy.

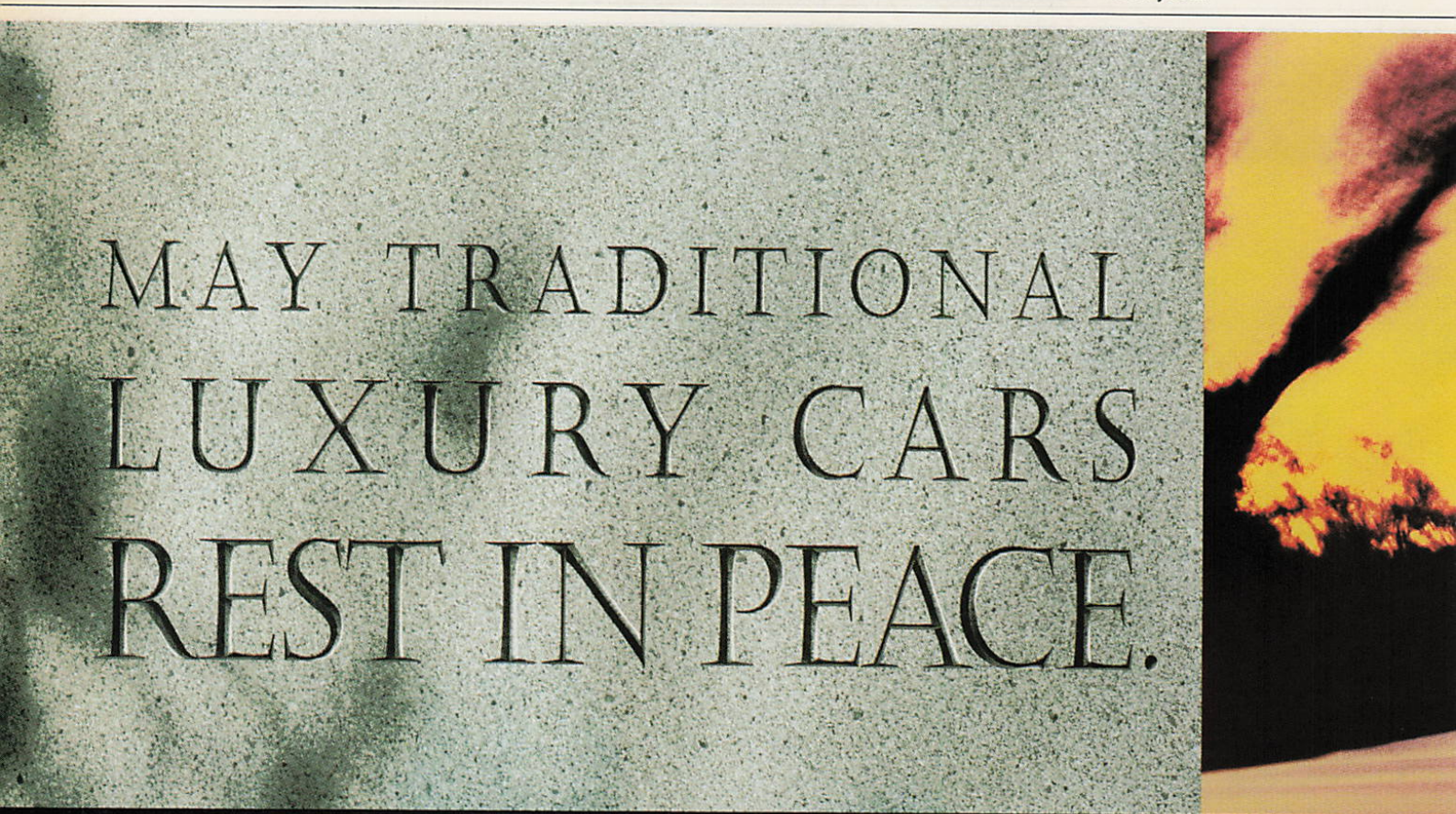
Don't lose sleep over it. The local event won't occur for 5 billion years. Astronomers believe that by then the Sun will have run out of fuel and life on Earth will be long gone.

Underwear Fights MS

Lowering the body's temperature by 1°F can help some people who suffer from multiple sclerosis (MS) regain motor control.

A novel way to provide this cooling has come from a most unexpected place, underwear developed for Apollo Moon-mission astronauts. Known as liquid-cooled garments (LCGs), these hooded vests were worn under spacesuits and provided protection against the temperature extremes of space.

MS afflicts about half a million Americans. Doctors who have worked with disabled patients testing LCGs say they provide sufficient relief from symptoms to enable some to reenter society and even hold jobs.



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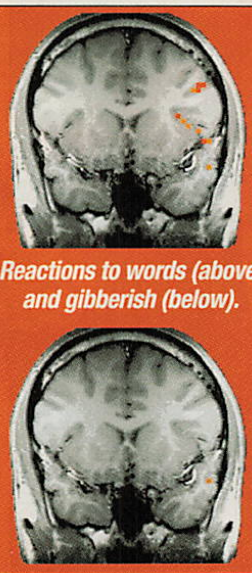
Peering Into A Thinking Brain

Magnetic resonance (MR) images can show brain activity as a person performs a simple task.

Researchers at Carnegie Mellon University and the University of Pittsburgh hope to take the next step soon by capturing the first-ever MR images of the human brain engaged in complex thoughts. Such images could reduce the risks of brain surgery.



Reactions to words (above) and gibberish (below).

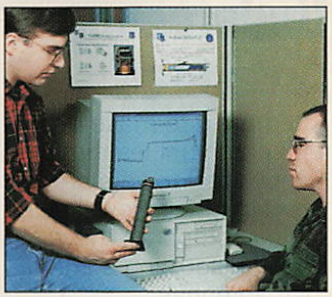
CARNEGIE MELLON UNIVERSITY

Battery Cuts Launch Costs

When you realize it costs $20,000 a pound to put a satellite into orbit, you can understand why engineers at the Air Force Space Vehicles laboratory are charged up about their new battery.

The rolling-pin-size sodium-sulfur battery weighs half as much as the nickel-hydrogen cells currently used in satellites. More important, it generates nearly three times as much power, about 150 watt-hours per pound of battery.

The new batteries may soon become standard equipment on satellites, such as the new cellular phone transponders, that operate in low-Earth orbits.



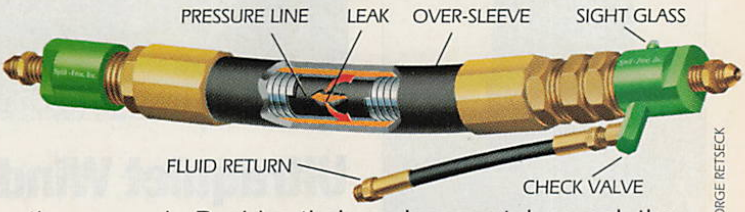
USAF

The sodium-sulfur battery undergoing testing for space.

No-Spill Hydraulic Fitting

Broken hydraulic lines do more than bring heavy equipment to a halt. They can lead to environmental cleanup bills costing thousands of dollars.

Spill-Free Inc., of Crossville, Tenn., believes its new connector could reduce damage caused by hydraulic line leaks. The connectors work much like a double hull on an oil tanker. Fluid leaking from a ruptured inner line is trapped by a surrounding over-sleeve and returned to the reservoir. Besides their environmental appeal, the connectors allow equipment with ruptured lines to continue operating.



GEORGE RETSECK

SSEi® model shown. ©1998 GM Corp. All rights reserved.

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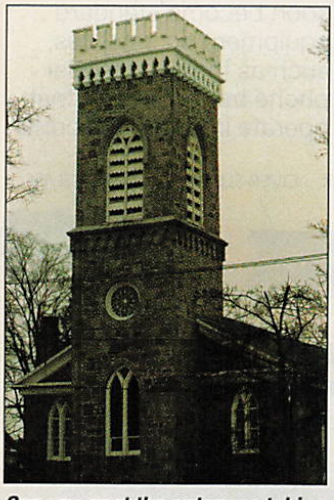
Undercover Antennas

Attempting to make peace with communities that say skinny steel towers are wrecking their views, cell-phone companies have begun disguising some of their antennas.

Not everyone is satisfied that dressing up the new neighbors makes them presentable. Tourist-dependent Vermont wants local governments, not the FCC, to issue future antenna permits.



NYT PICTURES/GEORGE RUHE

Can you spot the antennas taking sanctuary atop this church?

Cleaning Up History

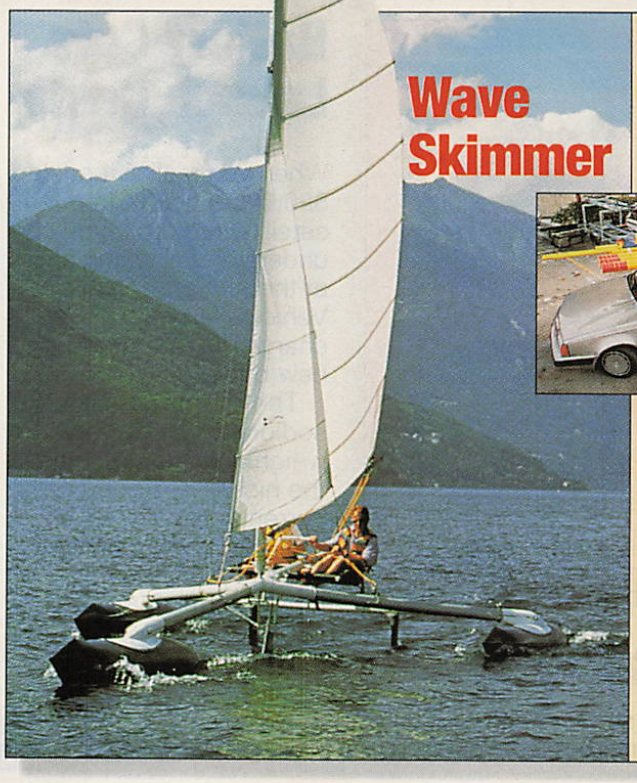
Historic districts in Europe are plagued by sloppy tourists and narrow roads.

FRENCH TECHNOLOGY PRESS OFFICE

Azura is only 4 ft. wide.

To clean streets built for feet, not Fiats, the French company Mathieu has shrunk its street sweeper.

You could soon see one even if you don't travel abroad. Mathieu says its Azura sweeper is also the perfect size for cleaning American shopping malls.



Wave Skimmer

Italian aircraft designer Pietro Terzi has developed a high-performance inflatable sailboat that he says will skim the waves in a light breeze.

Windspider fits in a roof rack.

The Windspider, left, consists of three inflatable hulls that are connected to aluminum tubes. The forward tube spans the length of the craft, forming a support for a pair of aft-mounted seats. Side tubes join the main tube below the mast, which lofts a mainsail and jib.

With 20-minute assembly and all parts under 20 pounds, you'll have plenty of time and energy for a day on the water.

PIETRO TERZI

Ultraquiet Wind Tunnel

Noise created by high-speed wind tunnels makes it hard to collect data about turbulence—information essential in designing future space planes.

"Ironically, the noise comes from turbulent air, the same phenomenon we're trying to study," says Purdue University researcher Steven Schneider.

Schneider's new 100-times-quieter wind tunnel will allow researchers to capture data now lost in the din. Instead of a fan, it uses a vacuum. When breached, air smoothly flows in—at Mach 6.

Purdue says the wind tunnel will be operational by December.

Model space planes will be tested in the Mach 6 tunnel.

PURDUE UNIVERSITY/RICHARD MYERS-WALLS

Natural Snap-Aparts

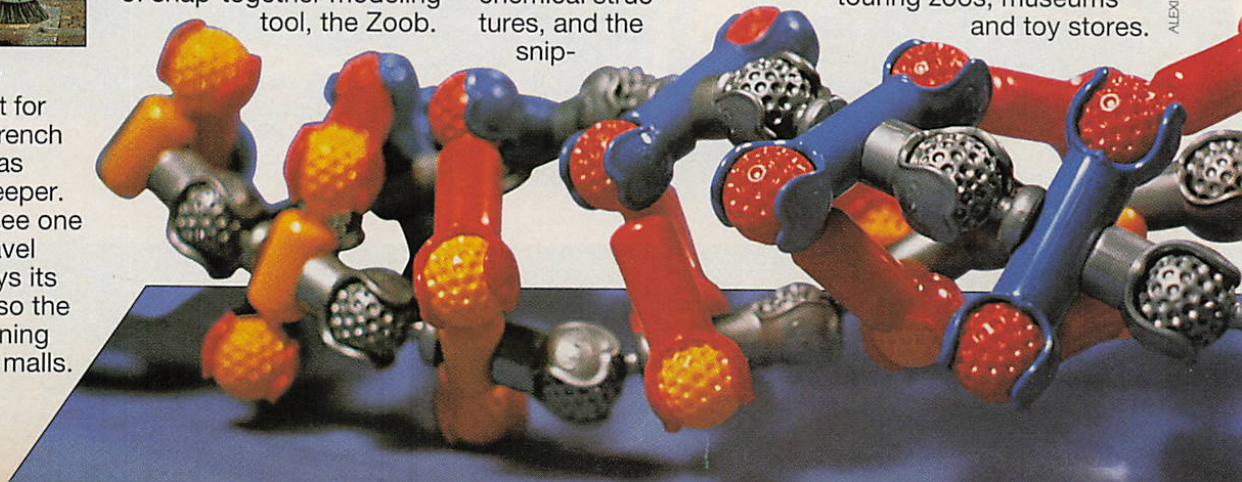
As an undergraduate science student at the University of California, Berkeley, Michael Joaquin Grey couldn't help but notice that nature never builds with straight lines. The observation inspired him to create a new type of snap-together modeling tool, the Zoob.

Zoobs are short plastic cylinders capped with spheres or mating concave clips. This arrangement enables joints between Zoobs to rotate. In so doing they can more accurately simulate organic forms like animal spines, chemical structures, and the snippet of DNA shown below.

Zoobs quickly caught the eye of scientists, whose children found them to be more fun than ordinary blocks.

To spread the word among other kids, Grey restored an old milk truck and christened it the "Zoobmobile." It is now touring zoos, museums and toy stores.

ALEXIS WILSON

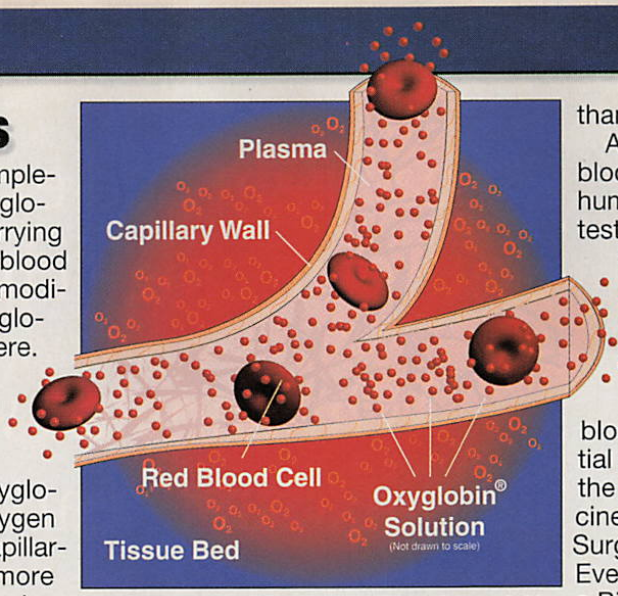


Artificial Blood For Dogs

Anemic dogs will be the first to benefit from artificial blood.

The FDA has given Biopure Corp., of Cambridge, Mass., permission to sell its Oxyglobin "artificial blood" solution to veterinarians as a treatment for canine anemia. The disease kills 4 million pooches a year and is largely untreated because so little donated dog blood is available, says Robert Murtaugh, of Tufts University.

Oxyglobin complements the hemoglobin—oxygen-carrying component—of blood with chemically modified cattle hemoglobin, as shown here. Because they are smaller than red blood cells, the hemoglobin molecules in Oxyglobin can carry oxygen into restricted capillaries, making it a more effective treatment than whole blood.

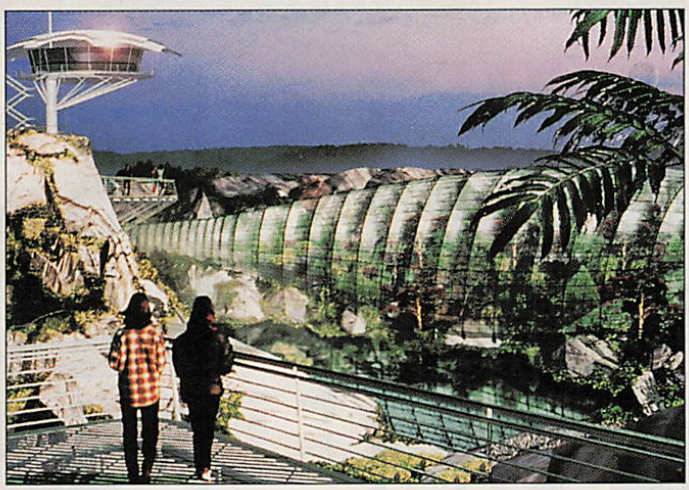


Oxyglobin carries more oxygen than hemoglobin.

A similar Biopure blood substitute for humans is now being tested as a treatment for sickle-cell anemia and as a replacement for donated blood during surgery.

"[Artificial blood] has the potential to revolutionize the practice of medicine," says former Surgeon General C. Everett Koop, who is a Biopure director.

BIOPURE



NICHOLAS GRIMSHAW & PARTNERS

Garden Of Eden Theme Park

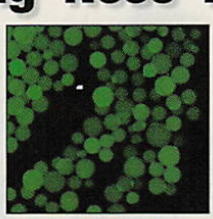
A Garden of Eden theme park is planned for an abandoned clay pit in southwest England.

Designed by architect Nicholas Grimshaw and his partners, the 15-acre park will seek to attract 750,000 visitors a year by displaying the 10,000 species of plants that are believed to have bloomed in the biblical Garden of Eden. The vegetation will be housed in plastic-membrane greenhouses supported by taut steel exoskeletons. One will be tall enough to allow trees to grow as high as 200 ft. The park, located in St. Austell, Cornwall, is scheduled to open in 2000.

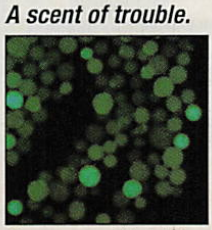
Fluorescing 'Nose' Knows

A "chemical nose" that glows when it detects diseased tissue has been developed by Columbia University researchers.

The nose consists of tiny beads coated with a compound that contains both a fluorescing molecule and a "quenching" fragment. On contact with target chemicals, the quenching fragment breaks off, causing the fluorescing tag to glow brighter, says developer Clark Still.



A scent of trouble.



Sensors get brighter.

A fully perfected chemical nose could detect pollutants faster and make medical diagnoses earlier than present technology. PM

COLUMBIA UNIVERSITY/CLARK STILL

Oldest Astronomical Site

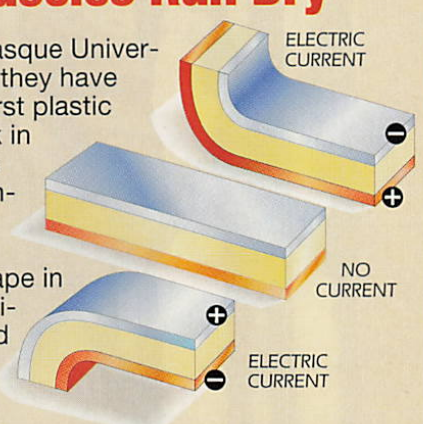
An assembly of huge stone slabs found in Egypt's Sahara Desert has been confirmed as the world's oldest celestial calendar. Known as Nabta, the site dates from between 6500 years and 6000 years ago. This makes it about 1000 years older than England's Stonehenge.

Originally Nabta, which is now dry, was believed to be only a religious site. New research reveals that during summers and falls thousands of years ago the individual stone slabs would have been partially submerged in a lake. They may have signaled the coming rainy season, says University of Colorado astronomer J. McKim Malville.

His discovery could rewrite ancient history. "The Nabta culture may have been a trigger for the development of social complexity in Egypt that later led to the Pharaonic dynasty," Malville says.

Plastic Muscles Run Dry

Researchers at Basque University, in Spain, say they have constructed the first plastic muscles that work in open air. Previous materials that mimicked human muscles by changing their shape in response to electrical stimulation had to be immersed in fluid.



The dry muscle consists of plastic impregnated with a lithium-perchlorate electrolyte and sandwiched between sheets of polypyrrole, a conductive polymer. Passing less than 1v through the electrolyte pushes the perchlorate ions, causing a slight swelling that remains until the current is removed. Depending upon the voltage, the swelling causes the muscle to flex in different directions, shown above.

The muscle's developers expect its first use will be in instruments for microsurgery. Plastic replacements for human muscle are at least 20 years away.

PAUL PERREAULT

"I eat right and exercise to control my high cholesterol.

Why should I worry about a first heart attack?"

©1998 Bristol-Myers Squibb Company, Princeton, NJ 08543

Diet and exercise may not be enough.

Pravachol reduces the risk of a first heart attack up to one-third.

Talk to your doctor about Pravachol. Lots of medications can lower cholesterol, but with Pravachol there's more. It is the only cholesterol-lowering drug of its kind proven to help prevent first heart attacks. Improving your diet and exercise is an important first step, but may not be enough. So ask your doctor about adding Pravachol to your diet and exercise regimen. In clinical studies, Pravachol has been taken by more people over a longer period of time than any other medication of its kind. Along with diet and exercise, Pravachol has been prescribed for millions of men and women. Pravachol. It could help you live a longer, healthier life.

Pravachol, in combination with diet and exercise, is proven to reduce the risk of a first heart attack, reduce the risk of death from heart disease and the need for heart surgery (such as bypass or angioplasty) based on a landmark study including over 6,500 males with high cholesterol and no evidence of heart disease. Because Pravachol is a prescription drug, you should ask your doctor or healthcare professional if Pravachol is right for you. As with most medications, Pravachol isn't for everyone, including women who are pregnant or nursing, or may become pregnant, people who are allergic to any of its ingredients or by anyone with liver disease. Your doctor may do simple blood tests to check your liver function before and during treatment with Pravachol. Some mild side effects, such as slight rash or stomach upset, occur in about 2–4% of patients. Muscle pain or weakness could be a sign of a rare but serious side effect and should be reported to your doctor right away. Be sure your doctor knows about other medications you may be taking in order to avoid any possible serious drug interactions. Please see important information on the next page. Ask your doctor if Pravachol is right for you. For more information on first heart attack prevention, call

1-800-PREVENT.

Visit our Web site at www.pravachol.com

PRAVACHOL®
pravastatin sodium 20 mg tablets

Proven to help prevent a first heart attack.

PRAVACHOL®

Pravastatin Sodium Tablets

CONTRAINDICATIONS: Hypersensitivity to any component of this medication. Active liver disease or unexplained, persistent elevations in liver function tests (see **WARNINGS**). *Pregnancy and lactation.* Atherosclerosis is a chronic process and discontinuation of lipid-lowering drugs during pregnancy should have little impact on the outcome of long-term therapy of primary hypercholesterolemia. Cholesterol and other products of cholesterol biosynthesis are essential components for fetal development (including synthesis of steroids and cell membranes). Since HMG-CoA reductase inhibitors decrease cholesterol synthesis and possibly the synthesis of other biologically active substances derived from cholesterol, they may cause fetal harm when administered to pregnant women. Therefore, HMG-CoA reductase inhibitors are contraindicated during pregnancy and in nursing mothers. **Pravastatin should be administered to women of childbearing age only when such patients are highly unlikely to conceive and have been informed of the potential hazards.** If the patient becomes pregnant while taking this class of drug, therapy should be discontinued and the patient apprised of the potential hazard to the fetus.

WARNINGS: Liver Enzymes: HMG-CoA reductase inhibitors, like some other lipid-lowering therapies, have been associated with biochemical abnormalities of liver function. Increases of serum transaminase (ALT, AST) values to more than 3 times the upper limit of normal occurring on 2 or more (not necessarily sequential) occasions have been reported in 1.3% of patients treated with pravastatin in the US over an average period of 18 months. These abnormalities were not associated with cholestasis and did not appear to be related to treatment duration. In those patients in whom these abnormalities were believed to be related to pravastatin and who were discontinued from therapy, the transaminase levels usually fell slowly to pretreatment levels. These biochemical findings are usually asymptomatic although worldwide experience indicates that anorexia, weakness, and/or abdominal pain may also be present in rare patients. In the largest long-term placebo-controlled clinical trial with pravastatin (Pravastatin Primary Prevention Study; See **Clinical Pharmacology**), the overall incidence of AST and/or ALT elevations to greater than three times the upper limit of normal was 1.05% in the pravastatin group as compared to 0.75% in the placebo group. One (0.03%) pravastatin-treated patient and 2 (0.06%) placebo-treated patients were discontinued because of transaminase elevations. Of the patients with normal liver function at week 12, three of 2875 treated with pravastatin (0.10%) and one of the 2919 placebo patients (0.03%) had elevations of AST greater than three times the upper limit of normal on two consecutive measurements and/or discontinued due to elevations in transaminase levels during the 4.8 years (median treatment) of the study. **It is recommended that liver function tests be performed prior to and at 12 weeks following initiation of therapy or the elevation of dose.** Patients who develop increased transaminase levels or signs and symptoms of liver disease should be monitored with a second liver function evaluation to confirm the finding and be followed thereafter with frequent liver function tests until the abnormality(ies) return to normal. Should an increase in AST or ALT of three times the upper limit of normal or greater persist, withdrawal of pravastatin therapy is recommended. Active liver disease or unexplained transaminase elevations are contraindications to the use of pravastatin (see **CONTRAINDICATIONS**). Caution should be exercised when pravastatin is administered to patients with a history of liver disease or heavy alcohol ingestion (see **CLINICAL PHARMACOLOGY: Pharmacokinetics/Metabolism**). Such patients should be closely monitored, started at the lower end of the recommended dosing range, and titrated to the desired therapeutic effect. **Skeletal Muscle: Rare cases of rhabdomyolysis with acute renal failure secondary to myoglobinuria have been reported with pravastatin and other drugs in this class.** Uncomplicated myalgia has also been reported in pravastatin-treated patients (see **ADVERSE REACTIONS**). Myopathy, defined as muscle aching or muscle weakness in conjunction with increases in creatine phosphokinase (CPK) values to greater than 10 times the upper normal limit, was rare (< 0.1%) in pravastatin clinical trials. Myopathy should be considered in any patient with diffuse myalgias, muscle tenderness or weakness, and/or marked elevation of CPK. Patients should be advised to report promptly unexplained muscle pain, tenderness or weakness, particularly if accompanied by malaise or fever. **Pravastatin therapy should be discontinued if markedly elevated CPK levels occur or myopathy is diagnosed or suspected. Pravastatin therapy should also be temporarily withheld in any patient experiencing an acute or serious condition predisposing to the development of renal failure secondary to rhabdomyolysis, e.g., sepsis; hypotension; major surgery; trauma; severe metabolic, endocrine, or electrolyte disorders; or uncontrolled epilepsy.** The risk of myopathy during treatment with another HMG-CoA reductase inhibitor is increased with concurrent therapy with either erythromycin, cyclosporine, niacin, or fibrates. However, neither myopathy nor significant increases in CPK levels have been observed in three reports involving a total of 100 post-transplant patients (24 renal and 76 cardiac) treated for up to two years concurrently with pravastatin 10-40 mg and cyclosporine. Some of these patients also received other concomitant immunosuppressive therapies. In one single-dose study, pravastatin levels were found to be increased in cardiac transplant patients receiving cyclosporine. Further, in clinical trials involving small numbers of patients who were treated concurrently with pravastatin and niacin, there were no reports of myopathy. Also, myopathy was not reported in a trial of combination pravastatin (40 mg/day) and gemfibrozil (1200 mg/day), although 4 of 75 patients on the combination showed marked CPK elevations versus one of 73 patients receiving placebo. There was a trend toward more frequent CPK elevations and patient withdrawals due to musculoskeletal symptoms in the group receiving combined treatment as compared with the groups receiving placebo, gemfibrozil, or pravastatin monotherapy (see **PRECAUTIONS: Drug Interactions**). **The use of fibrates alone may occasionally be associated with myopathy. The combined use of pravastatin and fibrates should be avoided unless the benefit of further alterations in lipid levels is likely to outweigh the increased risk of this drug combination.**

PRECAUTIONS: General: Pravastatin may elevate creatinine phosphokinase and transaminase levels (see **ADVERSE REACTIONS**). This should be considered in the differential diagnosis of chest pain in a patient on therapy with pravastatin. *Homozygous Familial Hypercholesterolemia.* Pravastatin has not been evaluated in patients with rare homozygous familial hypercholesterolemia. In this group of patients, it has been reported that HMG-CoA reductase inhibitors are less effective because the patients lack functional LDL receptors. *Renal Insufficiency.* A single 20 mg oral dose of pravastatin was administered to 24 patients with varying degrees of renal impairment (as determined by creatinine clearance). No effect was observed on the pharmacokinetics of pravastatin or its 3α-hydroxy isomeric metabolite (SQ 31,906). A small increase was seen in mean AUC values and half-life ($t_{1/2}$) for the inactive enzymatic ring hydroxylation metabolite (SQ 31,945). Given this small sample size, the dosage administered, and the degree of individual variability, patients with renal impairment who are receiving pravastatin should be closely monitored. **Information for Patients:** Patients should be advised to report promptly unexplained muscle pain, tenderness or weakness, particularly if accompanied by malaise or fever. **Drug Interactions:** *Immunosuppressive Drugs, Gemfibrozil, Niacin (Nicotinic Acid), Erythromycin:* See **WARNINGS: Skeletal Muscle**. *Antipyrine:* Since concomitant administration of pravastatin had no effect on the clearance of antipyrine, interactions with other drugs metabolized via the same hepatic cytochrome isozymes are not expected. *Cholestyramine/Colestipol:* Concomitant administration resulted in an approximately 40 to 50% decrease in the mean AUC of pravastatin. However, when pravastatin was administered 1 hour before or 4 hours after cholestyramine or 1 hour before colestipol and a standard meal, there was no clinically significant decrease in bioavailability or therapeutic effect. (See **DOSAGE AND ADMINISTRATION: Concomitant Therapy**.) *Warfarin:* In a study involving 10 healthy male subjects given pravastatin and warfarin concomitantly for 6 days, bioavailability parameters at steady state for pravastatin (parent compound) were not altered. Pravastatin did not alter the plasma protein-binding of warfarin. Concomitant dosing did increase the AUC and Cmax of warfarin but did not produce any changes in its anticoagulant action (i.e., no increase was seen in mean prothrombin time after 6 days of concomitant therapy). However, bleeding and extreme prolongation of prothrombin time has been reported with another drug in this class. Patients receiving warfarin-type anticoagulants should have their prothrombin times closely monitored when pravastatin is initiated or the dosage of pravastatin is changed. *Cimetidine:* The $AUC_{0\text{-}12\ hr}$ for pravastatin when given with cimetidine was not significantly different from the AUC for pravastatin when given alone. A significant difference was observed between the AUC's for pravastatin when given with cimetidine compared to when administered with antacid. *Digoxin:* In a crossover trial involving 18 healthy male subjects given pravastatin and digoxin concurrently for 9 days, the bioavailability parameters of digoxin were not affected. The AUC of pravastatin tended to increase, but the overall bioavailability of pravastatin plus its metabolites SQ 31,906 and SQ 31,945 was not altered. *Cyclosporine:* Some investigators have measured cyclosporine levels in patients on pravastatin, and to date, these results indicate no clinically meaningful elevations in cyclosporine levels. In one single-dose study, pravastatin levels were found to be increased in cardiac transplant patients receiving cyclosporine. *Gemfibrozil:* In a crossover study in 20 healthy male volunteers given concomitant single doses of pravastatin and gemfibrozil, there was a significant decrease in urinary excretion and protein binding of pravastatin. In addition, there was a significant increase in AUC, Cmax, and Tmax for the pravastatin metabolite SQ 31,906. Combination therapy with pravastatin and gemfibrozil is generally not recommended. In interaction studies with *aspirin, antacids* (1 hour prior to PRAVACHOL), *cimetidine, nicotinic acid,* or *probucol,* no statistically significant differences in bioavailability were seen when PRAVACHOL (pravastatin sodium) was administered. *Other Drugs:* During clinical trials, no noticeable drug interactions were reported when PRAVACHOL was added to: diuretics, antihypertensives, digitalis, ACE inhibitors, calcium channel blockers, beta-blockers, or nitroglycerin. **Endocrine Function:** HMG-CoA reductase inhibitors interfere with cholesterol synthesis and lower circulating cholesterol levels and, as such, might theoretically blunt adrenal or gonadal steroid hormone production. Results of clinical trials with pravastatin in males and post-menopausal females were inconsistent with regard to possible effects of the drug on basal steroid hormone levels. In a study of 21 males, the mean testosterone response to human chorionic gonadotropin was significantly reduced ($p < 0.004$) after 16 weeks of treatment with 40 mg of pravastatin. However, the percentage of patients showing a ≥ 50% rise in plasma testosterone after human chorionic gonadotropin stimulation did not change significantly after therapy in these patients. The effects of HMG-CoA reductase inhibitors on spermatogenesis and fertility have not been studied in adequate numbers of patients. The effects, if any, of pravastatin on the pituitary-gonadal axis in pre-menopausal females are unknown. Patients treated with pravastatin who display clinical evidence of endocrine dysfunction should be evaluated appropriately. Caution should also be exercised if an HMG-CoA reductase inhibitor or other agent used to lower cholesterol levels is administered to patients also receiving other drugs (e.g., ketoconazole, spironolactone, cimetidine) that may diminish the levels or activity of steroid hormones. **CNS Toxicity:** CNS vascular lesions, characterized by perivascular hemorrhage and edema and mononuclear cell infiltration of perivascular spaces, were seen in dogs treated with pravastatin at a dose of 25 mg/kg/day, a dose that produced a plasma drug level about 50 times higher than the mean drug level in humans taking 40 mg/day. Similar CNS vascular lesions have been observed with several other drugs in this class. A chemically similar drug in this class produced optic nerve degeneration (Wallerian degeneration of retinogeniculate fibers) in clinically normal dogs in a dose-dependent fashion starting at 60 mg/kg/day, a dose that produced mean plasma drug levels about 30 times higher than the mean drug level in humans taking the highest recommended dose (as measured by total enzyme inhibitory activity). This same drug also produced vestibulocochlear Wallerian-like degeneration and retinal ganglion cell chromatolysis in dogs treated for 14 weeks at 180 mg/kg/day, a dose which resulted in a mean plasma drug level similar to that seen with the 60 mg/kg/day dose. **Carcinogenesis, Mutagenesis, Impairment of Fertility:** In a 2-year study in rats fed pravastatin at doses of 10, 30, or 100 mg/kg body weight, there was an increased incidence of hepatocellular carcinomas in males at the highest dose ($p < 0.01$). Although rats were given up to 125 times the human dose (HD) on a mg/kg body weight basis, serum drug levels were only 6 to 10 times higher than those measured in humans given 40 mg pravastatin as measured by AUC. The oral administration of 10, 30, or 100 mg/kg (producing plasma drug levels approximately 0.5 to 5.0 times the human drug levels at 40 mg) of pravastatin to mice for 22 months resulted in a statistically significant increase in the incidence of malignant lymphomas in treated females when all treatment groups were pooled and compared to controls ($p < 0.05$). The incidence was not dose-related and male mice were not affected. A chemically similar drug in this class was administered to mice for 72 weeks at 25, 100, and 400 mg/kg body weight, which resulted in mean serum drug levels approximately 3, 15, and 33 times higher than the mean human serum drug concentration (as total inhibitory activity) after a 40 mg oral dose. Liver carcinomas were significantly increased in high-dose females and mid- and high-dose males, with a maximum incidence of 90 percent in males. The incidence of adenomas of the liver was significantly increased in mid- and high-dose females. Drug treatment also significantly increased the incidence of lung adenomas in mid- and high-dose males and females. Adenomas of the eye Harderian gland (a gland of the eye of rodents) were significantly higher in high-dose mice than in controls. No evidence of mutagenicity was observed *in vitro*, with or without rat-liver metabolic activation, in the following studies: microbial mutagen tests, using mutant strains of *Salmonella typhimurium* or *Escherichia coli*; a forward mutation assay in L5178Y TK +/- mouse lymphoma cells; a chromosomal aberration test in hamster cells; and a gene conversion assay using *Saccharomyces cerevisiae*. In addition, there was no evidence of mutagenicity in either a dominant lethal test in mice or a micronucleus test in mice. In a study in rats, with daily doses up to 500 mg/kg, pravastatin did not produce any adverse effects on fertility or general reproductive performance. However, in a study with another HMG-CoA reductase inhibitor, there was decreased fertility in male rats treated for 34 weeks at 25 mg/kg body weight, although this effect was not observed in a subsequent fertility study when this same dose was administered for 11 weeks (the entire cycle of spermatogenesis, including epididymal maturation). In rats treated with this same reductase inhibitor at 180 mg/kg/day, seminiferous tubule degeneration (necrosis and loss of spermatogenic epithelium) was observed. Although not seen with pravastatin, two similar drugs in this class caused drug-related testicular atrophy, decreased spermatogenesis, spermatocyte degeneration, and giant cell formation in dogs. The clinical significance of these findings is unclear. **Pregnancy: Pregnancy Category X.** See **CONTRAINDICATIONS**. Safety in pregnant women has not been established. Pravastatin was not teratogenic in rats at doses up to 1000 mg/kg daily or in rabbits at doses of up to 50 mg/kg daily. These doses resulted in 20x (rabbit) or 240x (rat) the human exposure based on surface area (mg/meter^2). However, in studies with another HMG-CoA reductase inhibitor, skeletal malformations were observed in rats and mice. There has been one report of severe congenital bony deformity, tracheo-esophageal fistula, and anal atresia (Vater association) in a baby born to a woman who took another HMG-CoA reductase inhibitor with dextroamphetamine sulfate during the first trimester of pregnancy. PRAVACHOL (pravastatin sodium) should be administered to women of child-bearing potential only when such patients are highly unlikely to conceive and have been informed of the potential hazards. If the woman becomes pregnant while taking PRAVACHOL (pravastatin sodium), it should be discontinued and the patient advised again as to the potential hazards to the fetus. **Nursing Mothers:** A small amount of pravastatin is excreted in human breast milk. Because of the potential for serious adverse reactions in nursing infants, women taking PRAVACHOL should not nurse (see **CONTRAINDICATIONS**). **Pediatric Use:** Safety and effectiveness in individuals less than 18 years old have not been established. Hence, treatment in patients less than 18 years old is not recommended at this time.

ADVERSE REACTIONS: Pravastatin is generally well tolerated; adverse reactions have usually been mild and transient. In 4-month long placebo-controlled trials, 1.7% of pravastatin-treated patients and 1.2% of placebo-treated patients were discontinued from treatment because of adverse experiences attributed to study drug therapy; this difference was not statistically significant. In long-term studies, the most common reasons for discontinuation were asymptomatic serum transaminase increases and mild, non-specific gastrointestinal complaints. During clinical trials the overall incidence of adverse events in the elderly was not different from the incidence observed in younger patients. **Adverse Clinical Events:** All adverse clinical events (regardless of attribution) reported in more than 2% of pravastatin-treated patients in the placebo-controlled trials are identified in the table below; also shown are the percentages of patients in whom these medical events were believed to be related or possibly related to the drug:

	All Events		Events Attributed to Study Drug	
Body System/Event	**Pravastatin (N = 900) %**	**Placebo (N = 411) %**	**Pravastatin (N = 900) %**	**Placebo (N = 411) %**
Cardiovascular				
Cardiac Chest Pain	4.0	3.4	0.1	0.0
Dermatologic Rash	4.0*	1.1	1.3	0.9
Gastrointestinal				
Nausea/Vomiting	7.3	7.1	2.9	3.4
Diarrhea	6.2	5.6	2.0	1.9
Abdominal Pain	5.4	6.9	2.0	3.9
Constipation	4.0	7.1	2.4	5.1
Flatulence	3.3	3.6	2.7	3.4
Heartburn	2.9	1.9	2.0	0.7
General				
Fatigue	3.8	3.4	1.9	1.0
Chest Pain	3.7	1.9	0.3	0.2
Influenza	2.4*	0.7	0.0	0.0
Musculoskeletal				
Localized Pain	10.0	9.0	1.4	1.5
Myalgia	2.7	1.0	0.6	0.0
Nervous System				
Headache	6.2	3.9	1.7*	0.2
Dizziness	3.3	3.2	1.0	0.5
Renal/Genitourinary				
Urinary Abnormality	2.4	2.9	0.7	1.2
Respiratory				
Common Cold	7.0	6.3	0.0	0.0
Rhinitis	4.0	4.1	0.1	0.0
Cough	2.6	1.7	0.1	0.0

*Statistically significantly different from placebo.

In the Pravastatin Primary Prevention Study (West of Scotland Coronary Prevention Study) (see **CLINICAL PHARMACOLOGY: Clinical Studies**) involving 6595 patients treated with PRAVACHOL (pravastatin sodium) (N = 3302) or placebo (n = 3293) the adverse event profile in the pravastatin group was comparable to that of the placebo group over the median 4.8 years of the study. The following effects have been reported with drugs in this class; not all the effects listed below have necessarily been associated with pravastatin therapy: *Skeletal:* myopathy, rhabdomyolysis, arthralgia. *Neurological:* dysfunction of certain cranial nerves (including alteration of taste, impairment of extra-ocular movement, facial paresis), tremor, vertigo, memory loss, paresthesia, peripheral neuropathy, peripheral nerve palsy, anxiety, insomnia, depression. *Hypersensitivity Reactions:* An apparent hypersensitivity syndrome has been reported rarely which has included one or more of the following features: anaphylaxis, angioedema, lupus erythematous-like syndrome, polymyalgia rheumatica, dermatomyositis, vasculitis, purpura, thrombocytopenia, leukopenia, hemolytic anemia, positive ANA, ESR increase, eosinophilia, arthritis, arthralgia, urticaria, asthenia, photosensitivity, fever, chills, flushing, malaise, dyspnea, toxic epidermal necrolysis, erythema multiforme, including Stevens-Johnson syndrome. *Gastrointestinal:* pancreatitis, hepatitis, including chronic active hepatitis, cholestatic jaundice, fatty change in liver, and, rarely, cirrhosis, fulminant hepatic necrosis, and hepatoma; anorexia, vomiting. *Skin:* alopecia, pruritus. A variety of skin changes (e.g., nodules, discoloration, dryness of skin/mucous membranes, changes to hair/nails) have been reported. *Reproductive:* gynecomastia, loss of libido, erectile dysfunction. *Eye:* progression of cataracts (lens opacities), ophthalmoplegia. *Laboratory Abnormalities:* elevated transaminases, alkaline phosphatase, and bilirubin; thyroid function abnormalities. **Laboratory Test Abnormalities:** Increases in serum transaminase (ALT, AST) values and CPK have been observed (see **WARNINGS**). Transient, asymptomatic eosinophilia has been reported. Eosinophil counts usually returned to normal despite continued therapy. Anemia, thrombocytopenia, and leukopenia have been reported with HMG-CoA reductase inhibitors. **Concomitant Therapy:** Pravastatin has been administered concurrently with cholestyramine, colestipol, nicotinic acid, probucol and gemfibrozil. Preliminary data suggest that the addition of either probucol or gemfibrozil to therapy with lovastatin or pravastatin is **not** associated with greater reduction in LDL-cholesterol than that achieved with lovastatin or pravastatin alone. No adverse reactions unique to the combination or in addition to those previously reported for each drug alone have been reported. Myopathy and rhabdomyolysis (with or without acute renal failure) have been reported when another HMG-CoA reductase inhibitor was used in combination with immunosuppressive drugs, gemfibrozil, erythromycin, or lipid-lowering doses of nicotinic acid. Concomitant therapy with HMG-CoA reductase inhibitors and these agents is generally not recommended. (See **WARNINGS: Skeletal Muscle** and **PRECAUTIONS: Drug Interactions**.)

OVERDOSAGE: To date, there are two reported cases of overdosage with pravastatin, both of which were asymptomatic and not associated with clinical laboratory abnormalities. If an overdose occurs, it should be treated symptomatically and supportive measures should be instituted as required.

CAUTION: Federal (USA) law prohibits dispensing without prescription.

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Bristol-Myers Squibb Company
Princeton, NJ 08543

J4-538F

Outdoors

Computer-Aided Kayaking

BY JIM GORANT

"The hardest part is going upstream," says Scott Shipley. No kidding. So I ask, why paddle upstream? "Well," he explains patiently, "slalom kayaking is a lot like slalom skiing. There are gates you have to maneuver around, and sometimes one gate actually sits upstream of another." Oh.

Shipley doesn't seem bothered by my lack of knowledge about competitive kayaking. Most of the people he encounters don't know a whole lot about it. But as little as the general public knows about whitewater kayaking, it seems the world of kayakers knows even less about modern technology.

JIMMY NATIONS PHOTO

World Cup champ Scott Shipley's new Predator II is the first kayak successfully designed using computers.

Shipley could be the man who brings all three—kayaks, people and technology—together. On one hand, he's an Olympic hopeful with the kind of human-interest story that attracts attention. On the other, he's an emerging designer who's built the first successful computer-designed kayak.

Rough Water

Whitewater kayaking is not an easy sport. The average course has 25 gates spread out over three-quarters of a mile of Class III or Class IV rapids. If you touch a gate, you get a 2-second penalty. Most pros run a course in about 2 minutes, and there's very little room for error. At one recent event, 1.3 seconds separated first place from 15th. The demands are both "technical and physical," says Shipley.

Within those rigorous standards, Shipley has excelled. "There are the three World Cups," he says when asked about his achievements, "two silver medals in the World Championships and six National Championships." He pauses. "And of course the two Olympics, which were disasters."

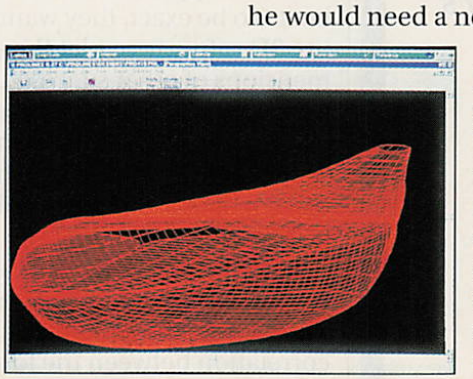
The Olympics are mentioned as an afterthought, as if Shipley assumes I already know about them. I do. Despite his being possibly the most celebrated kayaker of the last half dozen years, Shipley's career has been defined by his failure to win a medal at the 1992 or 1996 Olympics.

"Probably the biggest thing I learned is that the Olympics is just a race," he reflects. "It's the ultimate end-all, be-all race that everyone wants to win—but it's still just a race."

Indeed, Shipley returned to life as usual after the Atlanta games. He went back to Georgia Tech, where he studies mechanical engineering. He kept training, and set his sights on the 2000 Olympics in Sydney, Australia.

But first came the 1997 World Championships in Tres Coroas, Brazil. In order to prepare, Shipley attended a pre-Championship race late in 1996 in order to get a feel for the course. It did not go well, and the problem was his boat.

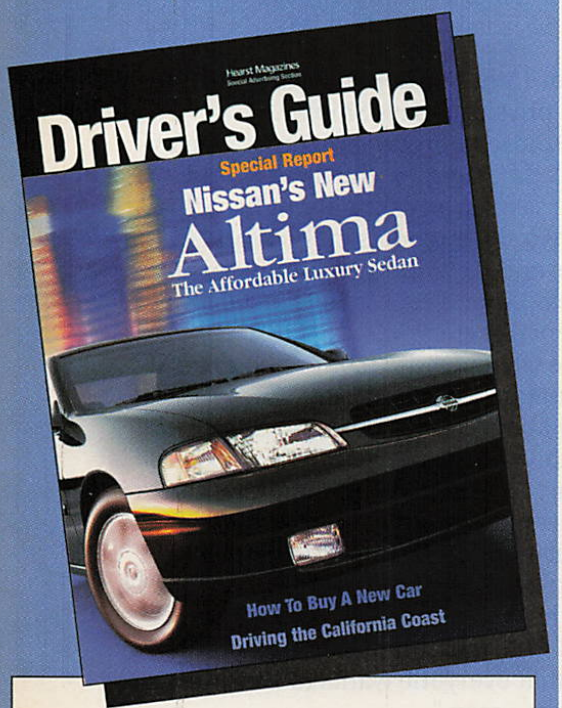
In 1995, Shipley had teamed with Dagger, the Harriman, Tenn., kayak builder, to design and build his kayak. The model, known as the Predator, excelled in fast, turbulent courses that required a lot of finesse. But the Brazilian course was relatively flat and slow-moving. If Shipley wanted a shot at becoming the first American to win the World Championship, he would need a new boat.



Naval architecture software helped, but Shipley had to design some as well.

For the first boat, Shipley had provided the specs and let others do the building. This time he wanted more involvement. Actually, he wanted to use computer software to analyze and incorporate the best traits of other successful boats, and he wanted to do it for college credit. Once Steve Scarborough, Dagger's vice

Hearst Magazines
Special Advertising Section
Driver's Guide



On the following pages, we are pleased to present *Hearst Magazines' Driver's Guide*, a special advertising section created specifically for new car buyers and adventurous travelers.

The *Hearst Magazines' Driver's Guide,* sponsored by Nissan Altima, features safe driving tips, a tour of the spectacular California coastline, a detailed look at how to buy a new car as well as valuable information on the new Nissan Altima.

We are sure you'll find the *Driver's Guide* useful and enjoyable.

Drive Safely,

Jay McGill
Vice President/Publisher
Popular Mechanics

Outdoors

president of engineering and design, and Georgia Tech signed on, the project was under way.

Then, just before work on the new boat started, Sydney organizers eliminated whitewater events from the Games because the cost of building a course was prohibitive. Shipley's Olympic hopes were gone.

Shaping Up

How backward is kayak design?

At one point, Shipley and Scarborough built a prototype hull, which they wanted to put through trials. But it didn't have a deck. No problem: Use the deck off the old boat. But when they laid the old deck on top of the new hull, the tails of the two boats did not line up. They checked the measurements: The aft end of the old boat was 3 in. off-center. For two years, Shipley had been paddling a bent boat.

What's more, he was pretty sure everyone else had been too. How come? Kayak designers are more artisans than engineers, and they shape new hulls by making plugs off old hulls and altering them with somewhat crude shaping and molding techniques. As it turned out, "All the major boats were designed off a boat called the Premier, which came out in 1981," says Shipley. "So someone made a mistake back then and we've all been copying it."

The pair wanted to take a more scientific approach to their new boat. To be exact, they wanted to use 3D software to plot the exact dimensions of other successful kayaks, then go out and actually use those kayaks. Based on the performance, they could determine which aspect of each boat's design contributed to its best characteristics.

In other words, if one boat turned really well and it had the deepest foresection, they could establish a correlation between the foresection and turning, etc. This works, in part, because competition kayaks must be 13 ft. 1 in. long and 23.62 in. wide, which limits the variables.

But first they had to overcome some software deficiencies. Standard naval engineering software can calculate velocity, resistance and turbulent flow, and other programs can produce 3D renderings that replicate waterlines and loading. But those are all for straight-line motion, of which there is little in whitewater kayaking. So Shipley had to combine those programs with his own adaptation of other software to come up with valid feedback for whitewater situations.

In the end, Shipley feels this combination of computer modeling and on-water testing produced the best results. "The U.S. Olympic Committee spent $48,000 having a bunch of naval architects design a kayak," Shipley offers as proof. "It stunk, because they didn't understand the problem with the software and no one ever actually paddled the boat."

Kayaks used to resemble canoes. Predator II looks more like a surfboard.

Home Stretch

To win the World Cup of slalom kayaking you have to finish with the best record over a 6-race circuit. After the first three races of the '97 season, Shipley had one medal. Then he launched his new boat, Predator II. In the next three races he earned two silvers and a gold and captured his third World Cup title. Overall, he's never finished worse than second.

And the good news keeps coming. In August, an Australian company offered to build a whitewater course, and kayaking is once again on the Olympic slate for 2000. So Shipley may just get his shot at Olympic redemption.

But it won't be easy. When the sport lost its status as a sanctioned event, Shipley lost the training grants he had been receiving from the U.S. Olympic Committee. The grants have been reinstated, but Shipley can never be sure what obstacle will be thrown in his path next. Sometimes you have to paddle upstream. PM

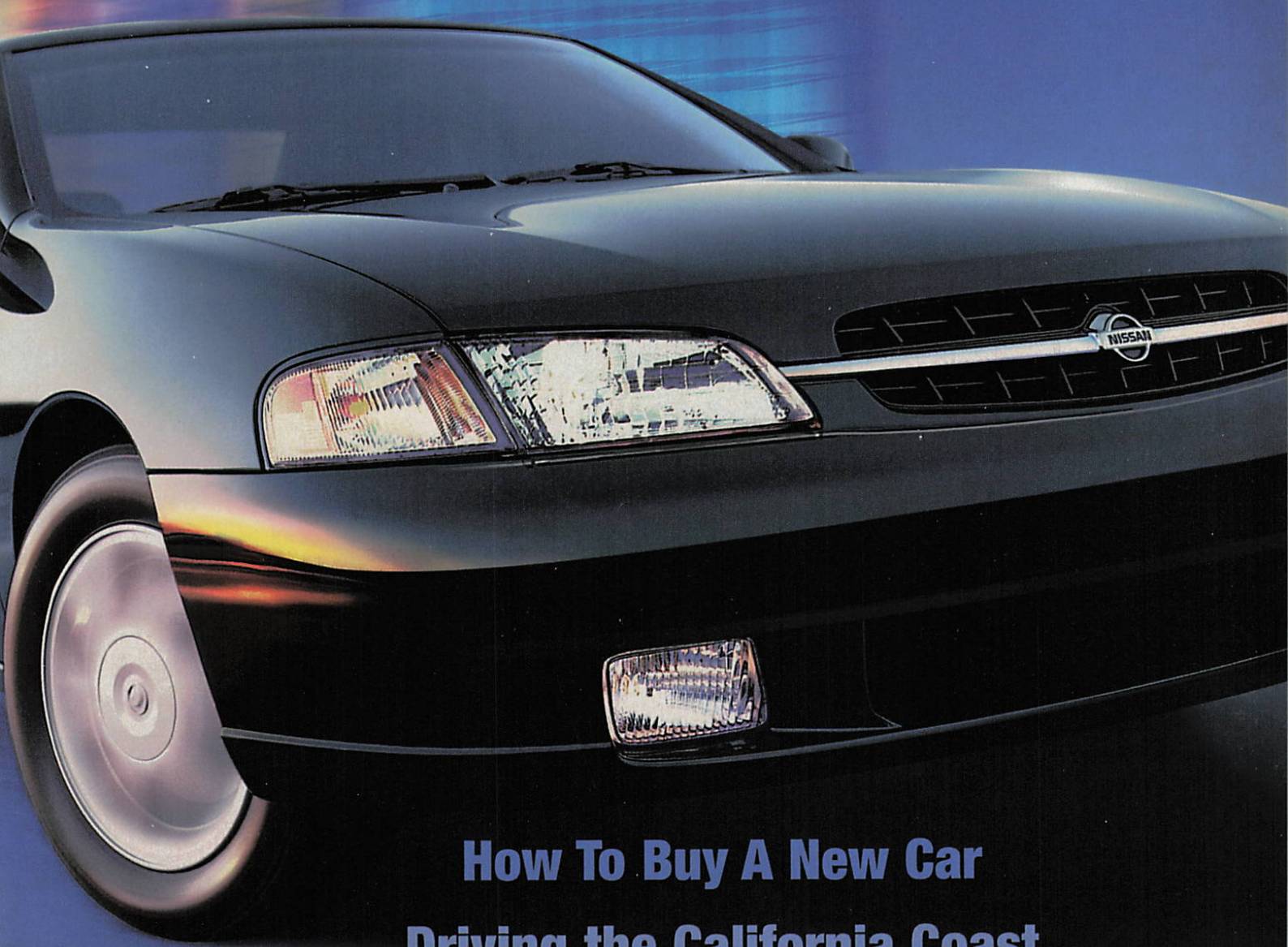
Hearst Magazines
Special Advertising Section

Driver's Guide

Special Report

Nissan's New Altima

The Affordable Luxury Sedan



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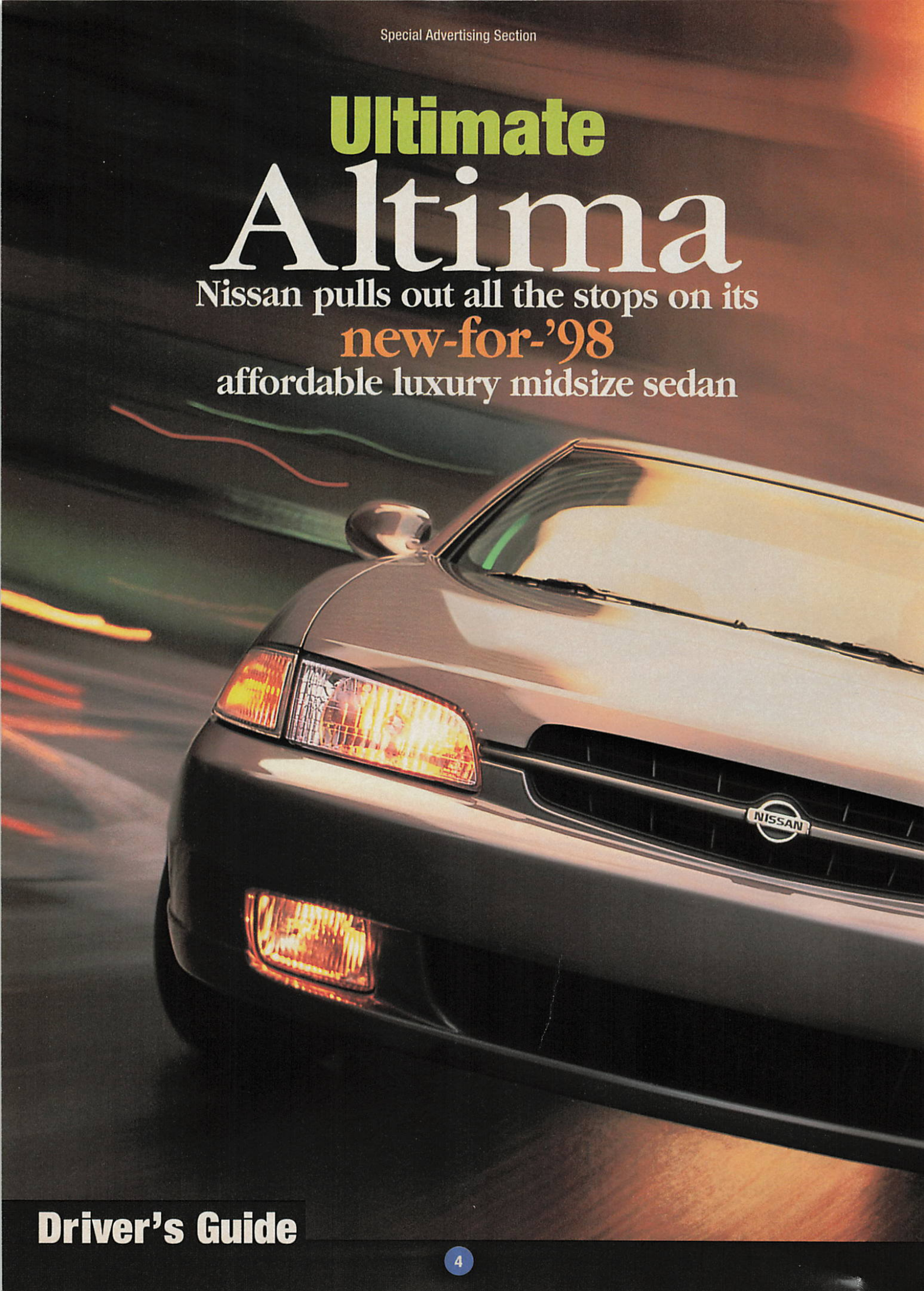
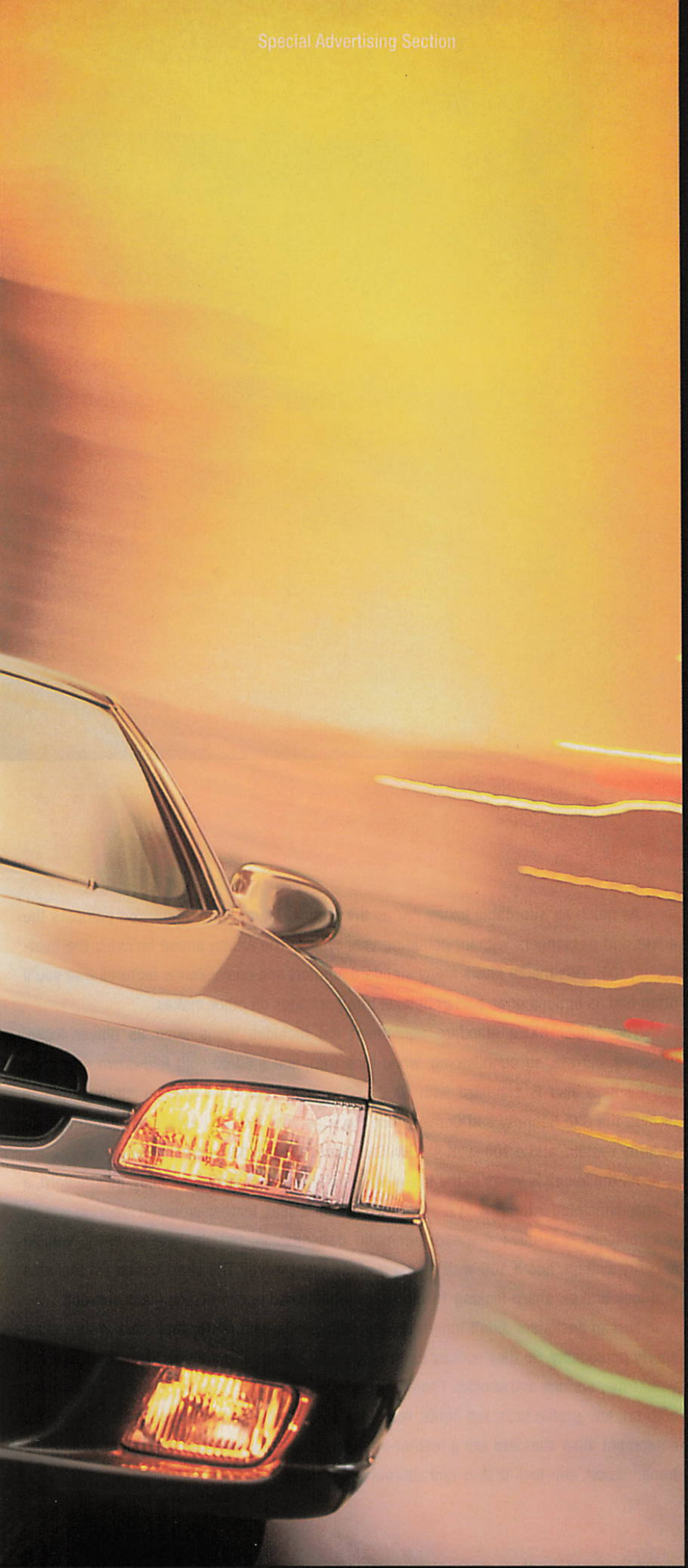
Ultimate Altima

Nissan pulls out all the stops on its new-for-'98 affordable luxury midsize sedan





New Cars

Call it **style**. Call it **flair**. Call it **personality**. Whatever you call it, the **Nissan Altima** has had it since its first day on sale in the fall of 1992. And when the competition stopped pointing, they started copying. So now, in order to keep Nissan's **top seller** fresh in the fiercely competitive midsize sedan category, the designers have reeled in the Altima for a **thorough makeover** for 1998.

But the designers had a problem. The original Altima is one of those cars that came out near perfect. It was Nissan design chief Jerry Hirshberg's masterpiece. Owners loved the car just the way it was. So how do you improve on **perfection** without messing it up?

Admittedly, the original Altima was a tough act to follow. It could out-slalom a BMW 325i, out-brake a Lexus ES 300 and out-accelerate a Mercedes-Benz 190E 2.3.* In the last few years, the Altima has been the **luxury car** just about everyone could afford. So what to do? What Nissan has done is gone back to a proven formula for the new 1998 Altima: **more car for less money**. Somehow, Nissan has managed to increase the value quotient of the Altima. Despite all the improvements, this year's sticker price on the top-selling Altima GXE automatic is $1,500 less than last year's. How do they do this stuff?

More car means just that. The new Altima is larger inside and out while planted on a **refined** version of the original platform. Designers stretched the '98 Altima's length by three inches, increased width by two inches, and also added more height. The cabin is roomier by about two cubic feet, so your size XXL friends will be comfortable and you can haul more cargo in the larger trunk.

As with the original, this **new-generation** Altima continues as a segment-styling **leader**. With clean, distinctive lines this car's a classic in the making. And although larger overall, the new model is even more aerodynamic than its predecessor. ►

*AMCI tests, July 1992. Base model comparison of the 1993 Altima XE vs. the 1992 BMW 325i, Lexus ES 300, and the Mercedes-Benz 190E 2.3 (0-60 MPH).

BEST VALUE. BEST BUY.

ALTIMA AWARDS

The Altima GXE
was awarded
A CONSUMERS DIGEST
BEST BUY FOR 1998.

Altima SE, GXE and GLE
also won
BEST OVERALL VALUE
in its class from
INTELLICHOICE.®*

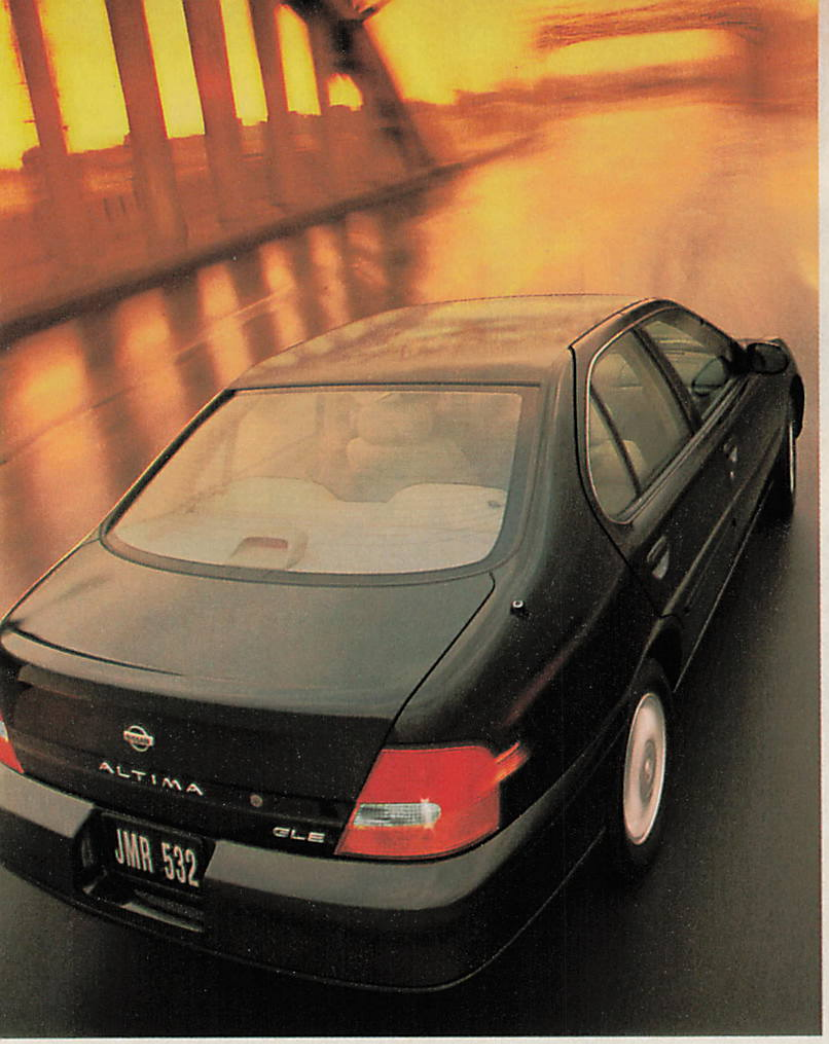
*** Compact class over $15,000,**
The Complete Car Cost Guide.®

As much an affordable luxury car as the original Altima, the '98 version pampers the driver and passengers without pounding your wallet. The Altima lineup includes the best-selling GXE. This model offers many standard comfort and convenience features that you'll often find as options or as part of uplevel trim packages on other makes.

The Altima GXE's standard equipment list includes items such as power locks, windows, mirrors, air conditioning, wood-tone trim, and a 60/40 split fold-down rear seat. Great sound also is standard with GXE's 60-watt AM/FM/CD 4-speaker stereo. Options include the GXE Security and Convenience Package with remote keyless entry and vehicle security system, and a 100-watt AM/FM/Cassette/CD 6-speaker sound system.

All the luxury is yours in the top-of-the-line Altima GLE. Here you enjoy, as standard, a leather-appointed interior with 8-way power driver's seat, leather-wrapped steering wheel, electronically controlled 4-speed automatic transmission, remote keyless entry, vehicle security system, and a 100-watt sound system. Want more? The short option list includes anti-lock brakes, sharp-looking 15-inch alloy wheels and power sliding glass sunroof.

Nissan designers didn't ignore driving enthusiasts who prefer their cars with a more sporty personality. So they cooked up the Altima SE, which offers a sport-tuned suspension with firmer springs and shocks. Then they added 4-wheel disc brakes, 15-inch alloy wheels with fat, low-profile tires, fog lights, rear deck spoiler and chrome exhaust tip as standard equipment. Also standard are a leather-wrapped steering wheel and shift knob. Automatic transmission, anti-lock brakes and sunroof are optional.



BEST LUXURY.

The new Altima is longer, wider and roomier inside than the previous model. Styling is decidedly more upscale, and the suspension is retuned for a smoother, quieter ride.

One really interesting touch on the SE is the unique white-faced electroluminescent gauges which appear as black type on a white field in daylight and reverse to white-on-black at night.

Sure, the new Altima is pleasing to look at and sit in, but getting behind the wheel and driving is what really puts a smile on your face. The 150 horsepower 4-cylinder engine, one of the most powerful in its class, has been improved for more power at lower speeds for better driveability. Powertrain improvements continue with a refined 4-speed automatic transmission—the same unit used in Nissan's top-of-the-line Maxima—for smoother shifts.

Good handling, the very essence of Nissan's fun-to-drive philosophy, has been honed to a more responsive level thanks to a number of improvements. The new Altima rides on a body platform that is 20% more rigid than the previous design. This allowed the engineers to move the wheels farther apart for a wider track front and rear, giving the whole platform more stability. These upgrades work with new liquid-filled engine mounts, reduced MacPherson strut friction and a recalibrated suspension for a noticeably smoother, more comfortable ride.

As with the first-generation Altima, the '98 models sold in North America are made at Nissan's plant in Smyrna, Tennessee, regarded as the world's most efficient automotive assembly plant. The advanced Intelligent Body Assembly System keeps the vehicle stationary while all the main panels are welded in place, which makes for very precise seam tolerances and one of the best built cars in the world for fit and finish.

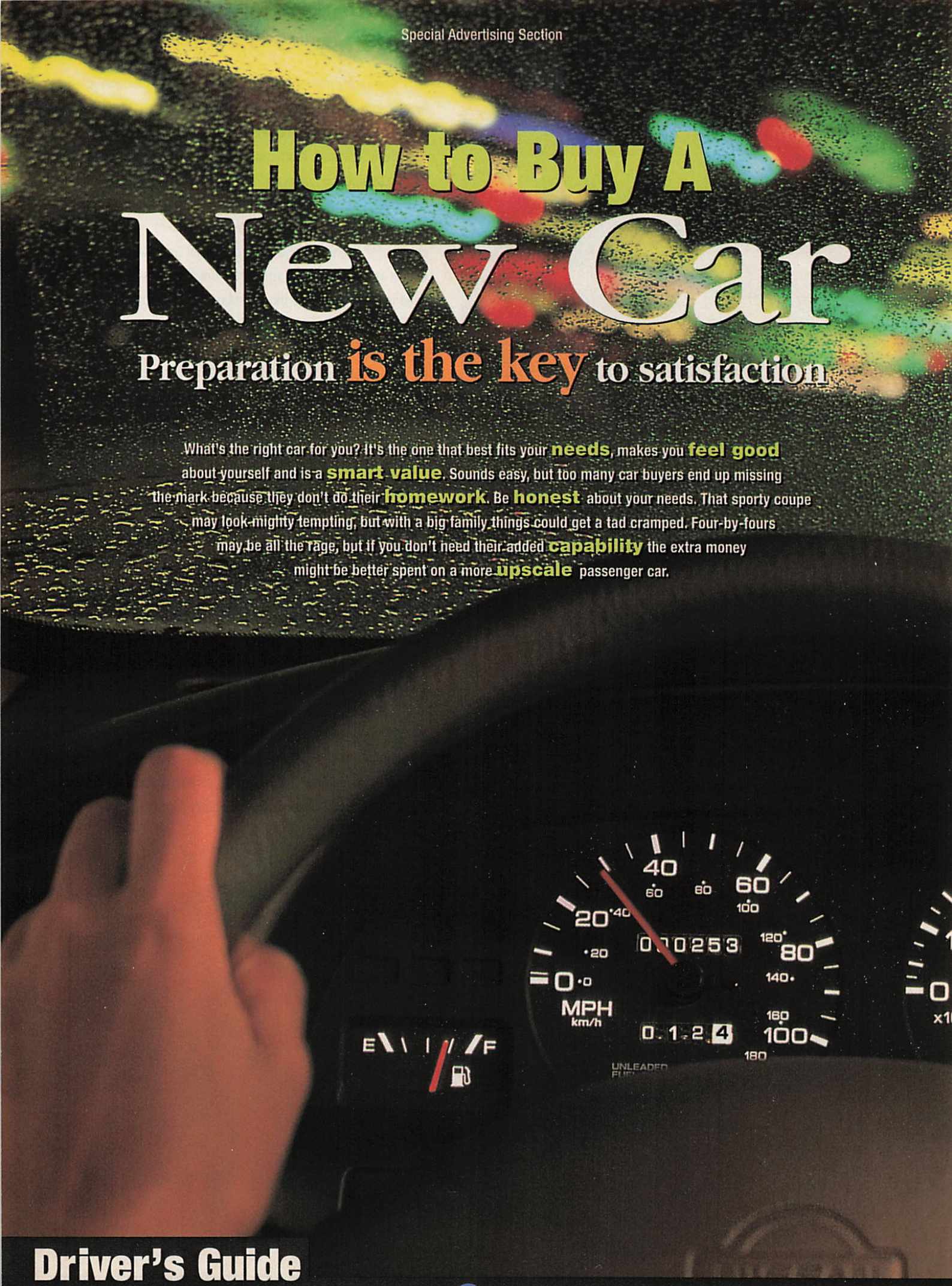
Lastly, special dent-resistant bake-hard steel panels are used in key body areas, which gives you an added line of defense against door dings and those free-rolling-attack shopping carts.

No matter which 1998 Altima you choose, you'll be in the good company of Altima owners who are already enjoying theirs.

How to Buy A New Car

Preparation is the key to satisfaction

What's the right car for you? It's the one that best fits your **needs**, makes you **feel good** about yourself and is a **smart value**. Sounds easy, but too many car buyers end up missing the mark because they don't do their **homework**. Be **honest** about your needs. That sporty coupe may look mighty tempting, but with a big family things could get a tad cramped. Four-by-fours may be all the rage, but if you don't need their added **capability** the extra money might be better spent on a more **upscale** passenger car.



Smart Consumer

Be realistic about how much car you can **afford**. Scrambling to come up with the payment every month can really be a turn-off. Remember, the last thing you want to do is make a car-buying choice on impulse.

Once you know the type of vehicle you want, you still have to choose from among any number that compete in the class. A car's **appearance** and **styling** obviously are important here, but value and **satisfaction** are even more important over the long haul.

Which car is best? Independent evaluations and recommendations go a long way toward identifying the **quality** players. IntelliChoice® awarded Altima SE, GXE and GLE the **#1** BEST OVERALL VALUE in its class. Altima also received A *CONSUMERS DIGEST* BEST BUY FOR 1998, and A FOUR-TIME *CONSUMERS DIGEST* BEST BUY. *Money Magazine* also was sufficiently impressed with Altima GXE to give it OUR BEST BUYS in the $15-20,000 category.

To see which car gives you the **most** for your money, determine the equipment you want and then compare standard equipment content and option packages.

Last, but most important: Never buy a car without first taking a **test drive**. It's the only way to determine the "feel" of the car—everything from interior roominess and how comfortable the seats are to ride and handling. It doesn't hurt to go in with a **checklist** of things to evaluate—such as engine response, steering effort and precision, ride control, brake response and noise level. If you expect to be living with your new car for awhile, it helps to first find out if you're compatible.

1998 Nissan Showroom

A SPECIAL MODEL FOR EVERY NEED.

Special needs require special vehicles, and Nissan has you covered. Want the added **capability** of a 4x4? Check out the **hot** Pathfinder. Minivan? Go for the **roomy** Quest. Want the **ultimate**? The Maxima is just the ticket. With **eight** models, Nissan has a car or truck for every need.

MAXIMA®
Nissan's flagship; the ultimate in luxury and performance.

ALTIMA®
Unexpected luxury at an affordable price.

SENTRA®
Lasting dependability; spirited performance.

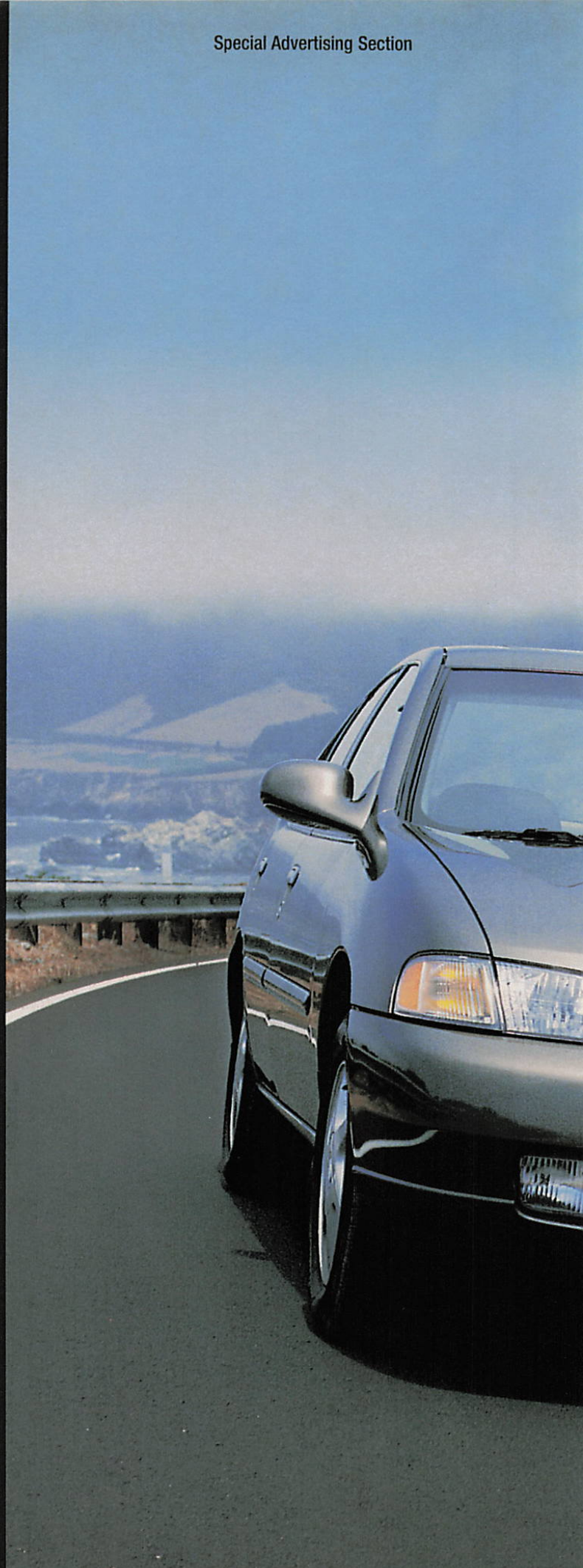
QUEST®
Comfortable family minivan.

240SX®
A true sports car in a refined package.

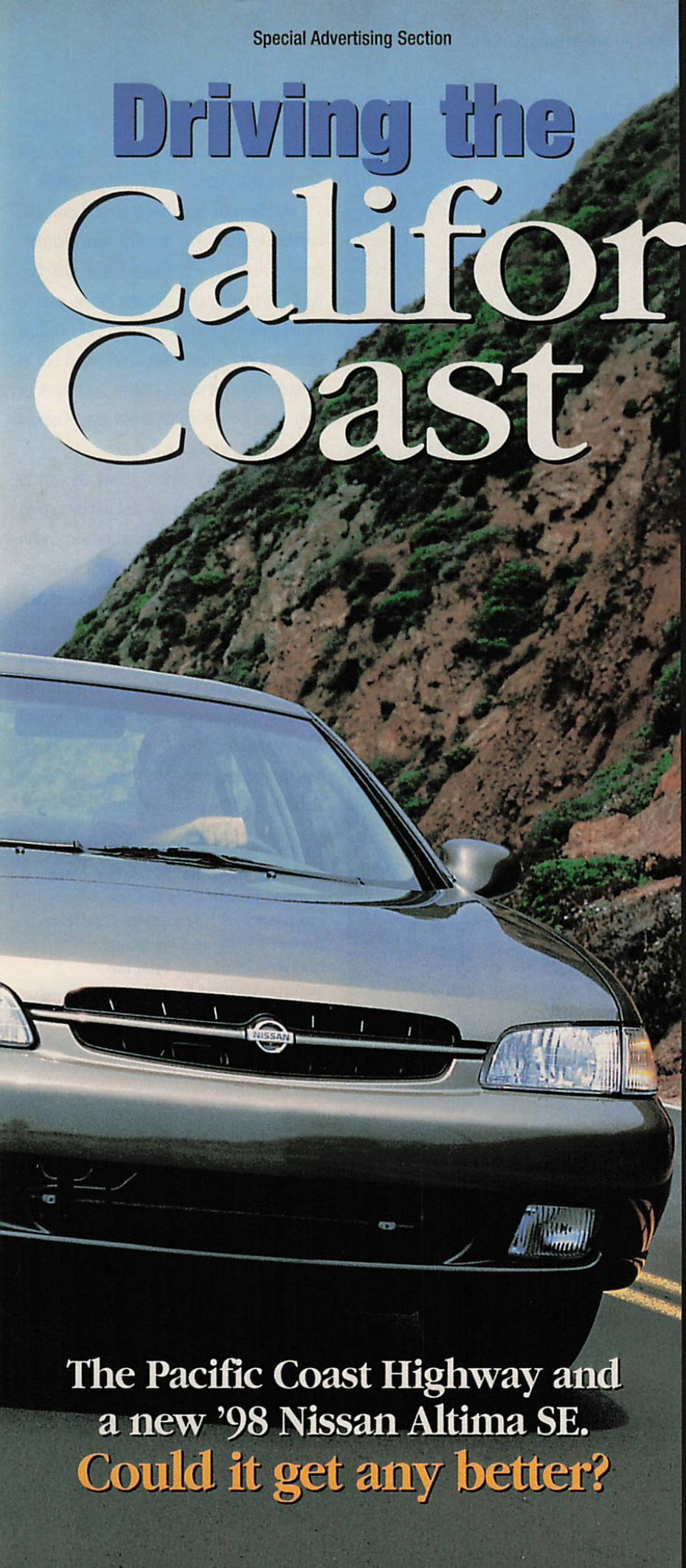
200SX®
Fun when you want it; versatile when you need it.

PATHFINDER®
The authentic sport utility vehicle.

FRONTIER™
The right tool for the right job.



Driving the California Coast



The Pacific Coast Highway and a new '98 Nissan Altima SE. Could it get any better?

What better way to try out Nissan's sporty new **Altima SE** than by touring from San Luis Obispo to Monterey Peninsula on the **twisting, turning, cliff-hugging** 181 miles known as California Route 1. This world-famous stretch boasts terrific **scenery**, world-class tourist destinations and some of the sweetest corners ever rolled into a piece of asphalt.

Our Altima was equal to the task. You may remember the widespread **excitement** in 1993 when Nissan's styling guru, Jerry Hirshberg, first presented the Altima, a benchmark car because it established a whole new style for midsize sedans. There are now more than 700,000 happy Altima owners, making this one of the most successful models in Nissan history.

Ironically, the Altima's **success** created an interesting problem for Hirshberg and his design team at Nissan Design International in La Jolla, California. What to do for an encore?

Their answer is the 1998 Altima, a larger car built off the same successful Altima platform. The wheelbase is still 103.1 inches, but the length now stretches out to 183.5 inches—3 inches longer than before. The new Altima is also 2 inches wider. Through **clever** engineering, the larger 1998 Altima weighs no more than the previous edition. Our test SE tipped the scales at 2992 lb. ready to go, conveniently svelte for a midsize sedan loaded with every possible option.

Chief Designer Doug Wilson has accomplished the most difficult of design challenges—producing a car that looks **new** and **fresh**, yet relates to the previous model. Every time we stopped during our drive up Route 1, people came over to examine the new Nissan. They knew it was a car they hadn't seen before, but they also recognized it as an Altima.

The '98 version has a higher rear deck and a ►

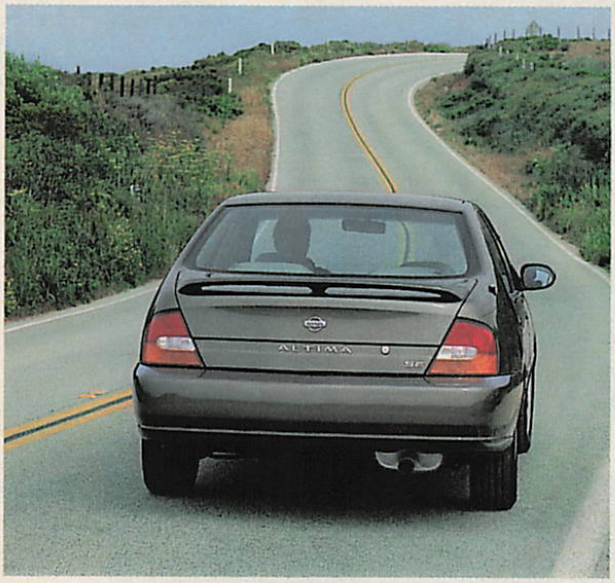
rising beltline under the side windows, which gives the car a more solid, mature stance. The turn signals have been removed from the front bumper and integrated into wraparound units along with multi-parabola halogen headlights. The grille is now a shallow oval crossed by a single grille bar.

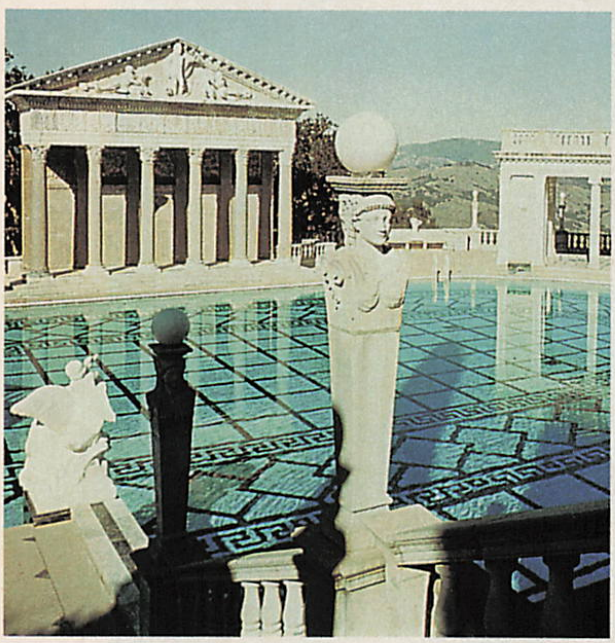
At the rear, the Altima is easily identified by large taillights cut off at an angle by the sides of the trunk lid. A neat little deck spoiler, stylish 6-spoke alloy wheels and fog lights tucked into an under-bumper air intake identified our test Altima as an SE. Eagle-eyed observers will also spot the SE's 4-wheel disc brakes.

The excellent Nissan chassis remains much as before. The 2.4-liter, DOHC, 16-valve 4-cylinder engine is rated a healthy 150 hp at 5600 rpm, though now it's been tuned for more low-end torque. This compact engine sits transversely under the low hood, driving the front wheels through your choice of a 5-speed manual or electronically controlled 4-speed automatic transmission. Thanks in part to efficient electronic fuel-injection, even the automatic transmission SE delivers 22 mpg City/30 mpg Highway. The manual gearbox raises these numbers to 24/31.*

The new Altima's interior is larger than before in almost every dimension and it is styled like those found in luxury sedans costing twice as much. A new 60/40 fold-down rear seat even let us carry the photographer's 6-foot step ladder in the trunk. Our test SE came with a leather-appointed interior, part of an optional package that also includes an 8-way power driver's seat with adjustable lumbar support.

Nissan sells the Altima in four trim levels, with prices that start at just $14,990. The most popular is the GXE model with automatic transmission, now stickered at $17,990. The sporty SE had a base price of $18,490, plus optional ABS, sunroof, leather appointed interior and automatic transmission, bringing the price to $21,187.**



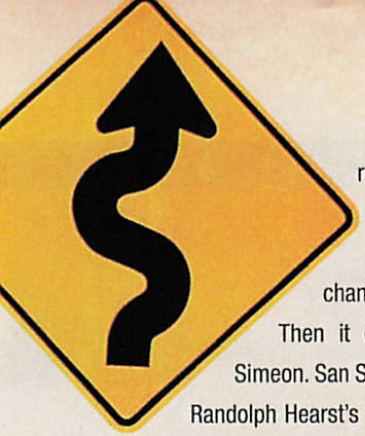


This is still competitive with other midsize sport sedans, many of which lack the Altima's style, power and plentiful options.

Our SE was beautifully turned out. The interior leather was a very "au courant" color, somewhere between taupe and tan, while the intriguing exterior paint was a green/gold metallic that Nissan calls Golden Olive. It's not a true "flip-flop" paint, but in different lights it reads mocha, olive drab or gold. Most people commented that it looked both rich and very chic.

What was our stylish Altima SE like to drive? Well, we started our test run by turning onto Route 1 at San Luis Obispo, heading north toward Morro Bay. Leaving Morro Rock behind, we were on a four-lane highway. But just past Cayucos, Route 1 changes to two lanes. For the first 10 miles, the road is comparatively straight, sweeping past picturesque old farms, working cattle ranches and beaches packed with Windsurfers. Our Altima cruised through the high-speed sweepers with world-class stability, the black-on-white tachometer

There's more to the Pacific Coast Highway than the 181 miles from Carmel to San Luis Obispo—there are plenty of interesting side trips. Hearst Castle in San Simeon features imposing Spanish architecture and a huge swimming pool with a Roman bath motif.



reading less than 3500 rpm even at our comparatively elevated rate of speed.

At Cambria, the landscape dramatically changes from open range to forested hills. Then it opens up again as you approach San Simeon. San Simeon, of course, is the location of William Randolph Hearst's incredible Hearst Castle, now a California Historic Monument. Hearst collected art and architectural ornaments from all over the world, then incorporated these bits into his soaring Spanish-style home built early in this century. Guided tours go through the house every day.

North of San Simeon, Route 1 becomes increasingly tight and twisty, as the landscape changes from cattle ranges to cliffs that rise dramatically out of the sea. The narrow asphalt is bordered by the Pacific on one side and Los Padres National Forest on the other. There are frequent washouts where the cliff has given way and taken Route 1 with it.

Now we were glad our Altima had the SE package that includes firmer-than-normal springs and shock absorbers, an oversize rear sway bar and Firestone P205/65R15 tires, as well as 4-wheel discs with ABS. Route 1 has a well-deserved reputation as a fabulous driving adventure, mostly based on this stretch from San Simeon to Big Sur.

The Altima SE can carve an apex like a sports car, while its superior torque rockets you out of the corners and its great brakes let you dive deep into the next turn. Get stuck behind traffic? No problem. Now you get to savor the views, the salt air, the smell of eucalyptus, the sun dancing on the water and the total experience of driving one of the world's great roads. Dial in a little New Age music on the Altima's standard 100-watt Clarion® CD stereo, and you'll be completely in tune with this fantastic stretch of California country.

The Altima SE can carve an apex like a sports car, while its superior torque rockets you out of the corners and its great brakes let you dive deep into the next turn.

As you twist and climb north, the pavement opens up again. There's more vegetation, mostly cypress and pine, more waves crashing on rocky outcrops. Big Sur is world famous for its rugged beauty, and justly so. A drive up Route 1 is the perfect opportunity to soak up some of the country's most beautiful scenery.

Another half-hour drive brings you to Monterey Peninsula, one of the great vacation destinations in the world. Carmel-by-the-Sea is quaint and touristy. Monterey preserves its mingled Spanish and New England heritage. Pacific Grove still feels like the quiet religious retreat from which it sprang.

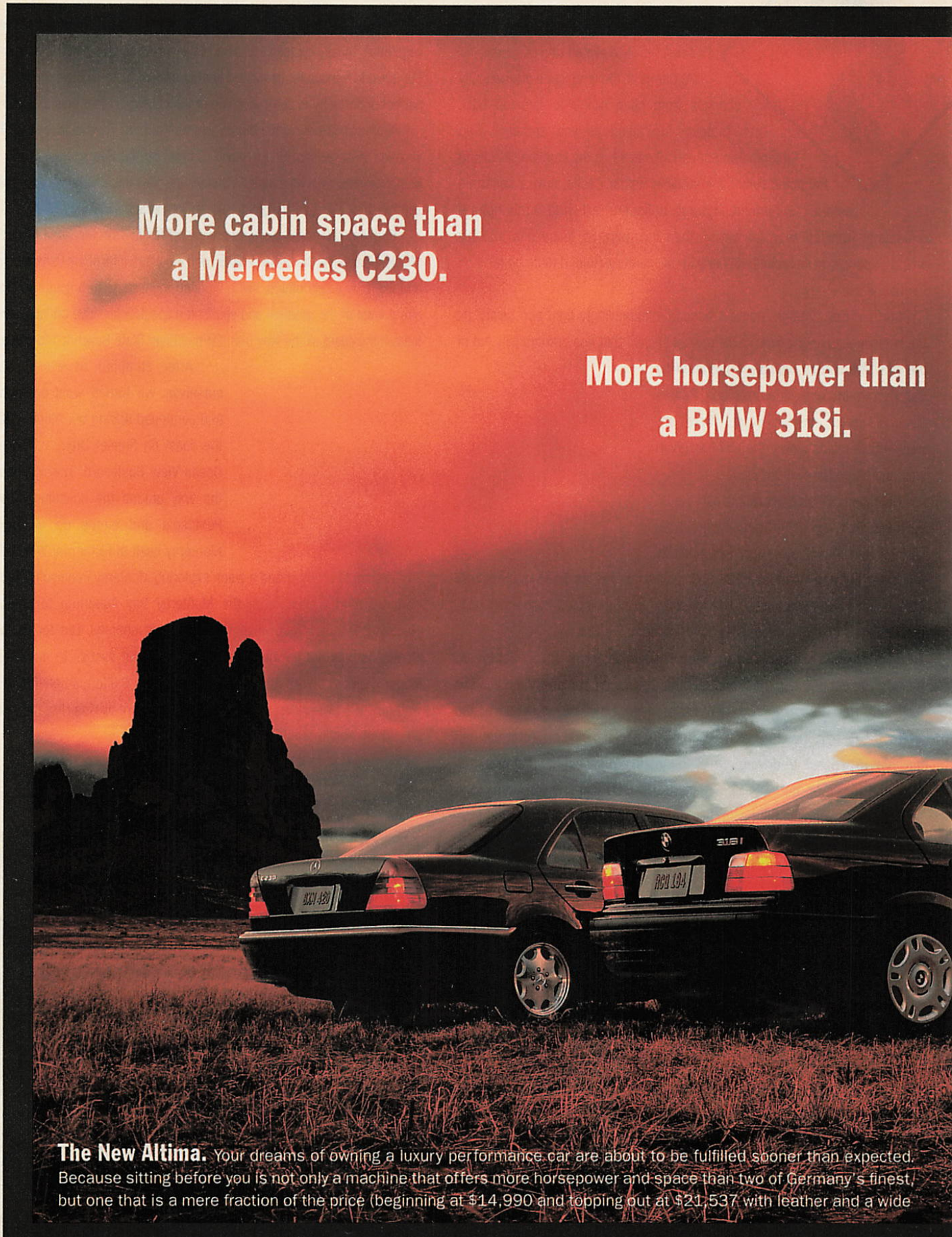
To follow the coast, we turned west off Route 1 on Rio Road toward Carmel Mission. Carmel is the second-oldest and most beautiful of the California missions, and like only a few others, still a working monastery. Turn south on almost any street west of the mission, and you'll hit a spectacular drive on local streets that follows the coast all the way from Carmel River State Beach to Monterey.

After stopping at every photo site ourselves, we turned west on Highway 68 and continued driving our Altima north along the coast on Sunset Drive, which becomes Ocean View Boulevard. This wrapped us all the way around the coastline of Monterey Peninsula and ended up in the city of Monterey itself at Fisherman's Wharf.

You could easily spend a week exploring Monterey Peninsula. There are all sorts of tourist sites, from the Monterey Bay Aquarium to Laguna Seca Raceway to nearly two dozen separate golf courses. But for us, Monterey Peninsula was not so much a destination as an excuse to drive the Pacific Coast Highway. Every mile of the drive up the California coast is interesting and fun. We were never bored. But then, we were driving Nissan's new Altima SE, which generates an excitement all its own.

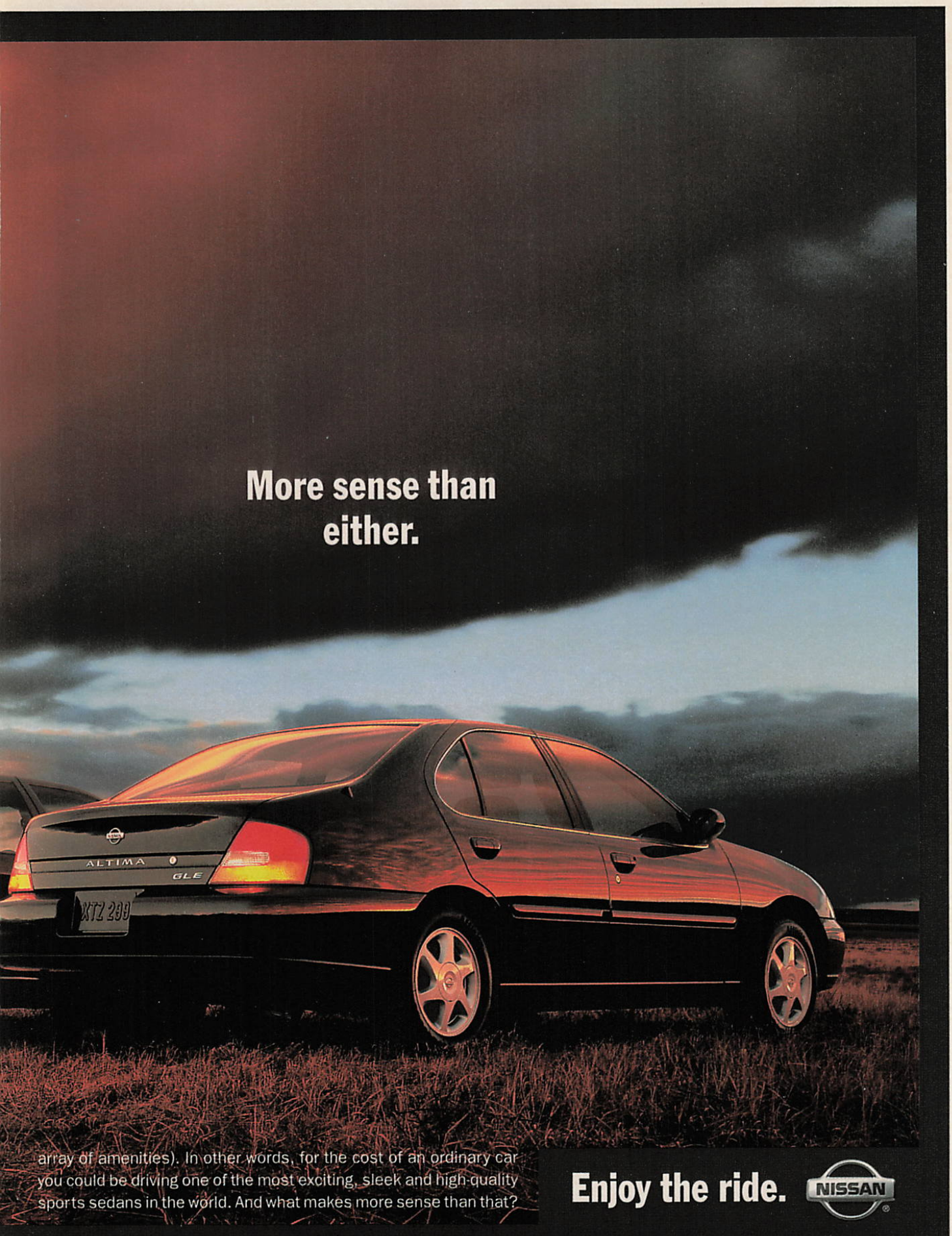
*Based on 1998 EPA fuel economy estimates. Actual mileage may vary with driving conditions. Use for comparison only.

**Prices exclude taxes, title, license and destination charge. Retailers set actual price.



The New Altima. Your dreams of owning a luxury performance car are about to be fulfilled sooner than expected. Because sitting before you is not only a machine that offers more horsepower and space than two of Germany's finest, but one that is a mere fraction of the price (beginning at $14,990 and topping out at $21,537 with leather and a wide

GLE model shown. 1998 Altima XE priced from $14,990, 1998 Altima GLE at $21,537 includes ABS, alloy wheels and sunroof. All MSRPs exclude taxes, title, license, $490 destination charge



array of amenities). In other words, for the cost of an ordinary car you could be driving one of the most exciting, sleek and high-quality sports sedans in the world. And what makes more sense than that?

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Technology

Be A Power Player

BY KIM KOMANDO

This Gateway computer system is one of many new power players.

No doubt, the under-$1000 PC is an important development for computerists on a shoestring budget. But it's still true that, most of the time, you get what you pay for. And for those of us who really enjoy our hardcore tech (myself included),

THE KOMANDO REPORT

COMPUTERS

the fastest, most powerful PC is worth the price—no matter what. However, brace yourself for sticker shock. To really feel the power in a computer system, you're going to pay at least double the price of a cheap consumer model.

Sampling The Vendors

For starters, consider **Micron**'s Millennia XKU **(http://www.micronpc.com)**. This system sports a 300-MHz Pentium II processor with 64MB of SDRAM memory and a 512K Level 2 cache as standard equipment, all packed into a minitower case.

There's no skimping on video, either. The system's Advanced Graphics Port (AGP) slot is equipped with a Diamond Viper AGP video card. This puts true 128-bit video at your disposal, which translates to outstanding 2D, 3D and video playback. To show off all this video power, the Millennia XKU also comes standard with a 17-in., .26mm monitor. For multimedia, you're looking at a 32X CD-ROM drive, a Yamaha wavetable soundcard, and a pair of good speakers.

If you're planning to work (or play) with 3D and video, you need to store huge files. Inside, there is a 6.4GB ATA-33 hard drive that supports burst transfer speeds of up to 33Mbps. Need to get connected? The Millennia XKU includes a dual-speed network interface card (NIC) that can run at either 10Mbps or 100Mbps and auto-senses the correct speed.

You Want More?

At about $2350 as of this writing, the standard Millennia XKU is a darn good system. But what if it's not good enough? When you start adding on a few little extras, the price climbs dramatically. For example, if you want the fastest CPU available, you'll have to bump yourself up from the 300-MHz Pentium II to the 333-MHz version. This modest gain in speed will set you back an extra $200.

If you'd like to add a Zip drive, you can do so for another $99. You'll be trading in the floppy-only drive for a combo 3.5-in.-floppy/Zip drive.

How about some extra multimedia muscle? Go ahead, you're worth it. Trade out the CD-ROM for a DVD drive ($199), move up to a Number Nine Revolution 8MB AGP video card ($159), and upgrade to a Creative Labs AWE 64 soundcard ($75).

Oops! You say there's no modem yet? No problem, you can add a USR x2 modem ($119). And finally, why not bulk up with 2GB more disk space ($50) and double the RAM ($248) for good measure? Better reach for the platinum card, though: The price tag on the revised configuration is about $3380.

The Cows Have Come Home

Gateway2000 (http://www.gw2k.com) has been advertising its lower-cost systems pretty steadily on TV lately, but it also offers a wide range of high-end systems. For example, the G6-333HE starts with a 333-MHz Pentium II processor, 64MB of SDRAM, a 512K L2 cache, and a 6.4MB ATA hard drive. For video and multimedia, the G6-333HE includes a 17-in. monitor, an nVidia 4MB AGP video card, a DVD/floppy-drive combo, an Ensoniq soundcard, and speakers.

At $2499, it's comparable to the Millennia XKU base system. Naturally, there's still plenty of room to grow. Just as with the XKU, you can double the RAM ($192) and add 2GB to the hard drive ($75).

For more multimedia sizzle, you can trade the standard video card for an Accelgraphics Permedia 2, 8MB AGP video card (only $30) and upgrade the speakers to Boston Acoustic Media Theater speakers with surround sound ($150). And, what the heck, throw in a PCI-

based TV/FM tuner card ($119) for good luck.

The G6-333HE doesn't include a network card, so you'll have to add a 3Com PCI-based 10/100 NIC ($64). For removable mass storage, you can choose between a Zip drive and an LS-120 drive ($99 either way). Since the G6-333HE includes an x2 modem, these additions make this system roughly the same as the souped-up Millennia XKU described earlier. The cost: about $3230—within $50 of the Micron system.

The Micron Millenia comes in high on the muscle scale.

Dell's Still Strong

Dell Computer (http://www.dell.com) was the first major player to offer custom-configured systems for direct purchase and for the high-end user. Its Dimension XPS D series certainly fits the bill.

The top-of-the-line Dimension XPS D333 base system is configured like the systems mentioned above. It sports a 333-MHz Pentium II processor, 64MB of SDRAM, a 512K L2 cache, and a 6.4MB ATA hard drive. Like the G6-333HE, it includes an nVidia 4MB AGP video card, and like the XKU, it includes a 32X CD-ROM drive.

In a departure from the other systems, the standard monitor for the XPS D333 is 19 in., and sound is delivered by a Yamaha wavetable soundcard through Altec Lansing ACS495 speakers. This base system sells for $2702.

In the upgrade arena, Dell charges the same as Micron for an upgrade to 128MB of RAM ($248). Going from a 6.4GB hard drive to an 8.4GB drive is also comparable ($49). Similar to Gateway2000, Dell offers a Diamond Permedia 2, 8MB AGP video card as an option ($49). A Zip drive ($99) and a 3Com 3C905-TX 10/100 NIC ($79) are also offered as options. However, conspicuously missing from the options list at this writing is a DVD drive.

Configured with these enhancements, the Dimension XPS D333 sells for about $3230. That's in line with the other systems mentioned here—but remember, this doesn't include a DVD drive, which leaves you out in the cold if you're looking for good movie action. On the other hand, the standard monitor included with the XPS D333 is somewhat larger.

Just to put this whole discussion in perspective, consider **Apple**'s high-end Power Macintosh system. Based on the new 266-MHz G3 processor (which Apple claims can outperform the fastest Pentium II), this system ships with 128MB of RAM and a 4GB SCSI hard drive.

For video/multimedia, the system includes a 20-in. Apple monitor, a built-in ATI 3-D RAGE II+ 64-bit graphics and multimedia accelerator chip, 6MB of video RAM, and a 128-bit graphics card. A 10/100 NIC is also included, as is a 24X CD-ROM drive. The cost of this base system—are you sitting down?—is about $5450!

Furthermore, if you bump the hard drive up to 9GB ($450), add a Zip drive ($120) and include an internal 56K modem, you're looking at about $6150. Like Dell, Apple currently lists no option for DVD.

There are two lessons here. First, if you're looking for a real screamer of a Windows system, you can expect to pay about $3300 no matter where you go. And if you just can't live without a top-notch Mac, expect to pay a real premium—nearly double, in fact.

Reroute Your Long-Distance Calls

BY TOBEY GRUMET

TELECOMMUNICATIONS

Long-distance phone calls seem like such a scam to me. It's bad enough I can't just hop on a plane to see my far-placed loved ones without paying large sums of cash—but I have to pay outrageous phone bills if I call them before they're asleep on a weeknight (i.e., 11:30 pm)? I think not.

So when new Internet/telephony gadgets caught my eye at this year's Internet World convention in Los Angeles, I immediately saw visions of severe savings on my phone bills.

If these Internet/telephony devices catch on, they could represent an alternative to the horrors of the giant phone company. Instead of using the normal communications route to make a phone call, these devices will automatically switch your long-distance call to a local ISP (Internet service provider) of your choice, which will then reroute that same call through the Internet. The person on the other

(Please turn to page 52)

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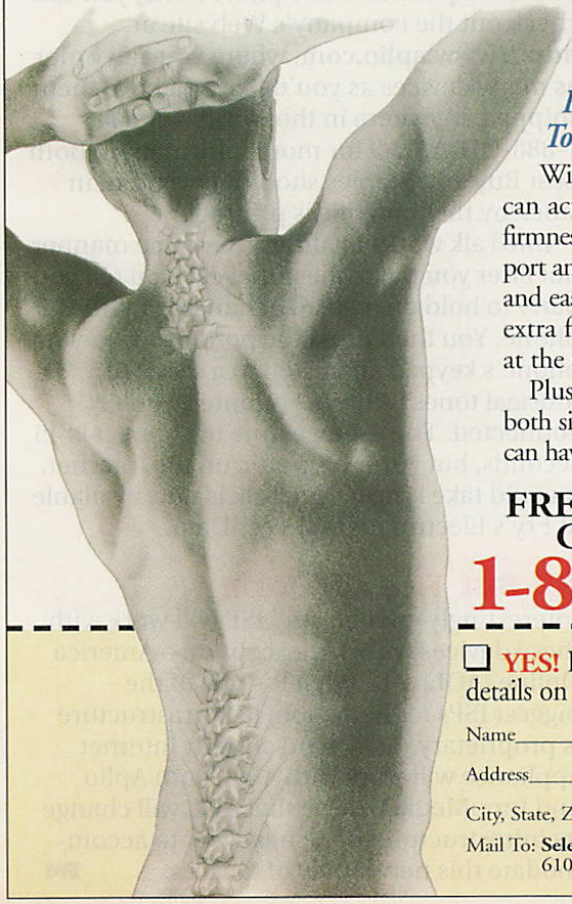

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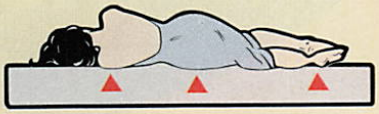
▼ ***Metal Coil Mattresses*** *can create uncomfortable pressure points and provide uneven support over time.*



▼ ***Many Waterbeds*** *can cause a "hammock" effect as the water beneath you displaces resulting in a bending of the spine.*

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end of the line must also have an ISP account and an Internet/telephony device. So when push comes to shove, the only thing you end up paying for is that local connection! Is Mom across the country, or are you in one of those dreadful long-distance relationships? Here's an answer. But remember, because it's using the Internet, connections are not of the utmost quality—in fact, it's about as good as a digital cellular phone connection. Also bear in mind that this is brand-new stuff—and like most fledgling technologies, there may be some bugs—including a ½-second delay that kicks in when speaking to your party, sort of like many current overseas connections.

The Aplio/Phone can save money on long-distance calls.

Over The River And Through The Woods

Unlike a conventional phone call, which goes through what is called the public switch telephone network—made up of antennas, satellites and dedicated phone lines—your call will travel through the Internet with this new technology. Your long-distance calls are currently expensive simply because charges are based on how far the calls travel. So, the farther a call goes, the more you cough up. And some countries are worse than others. In Canada, calling from east to west on a common basis could easily pauperize the average consumer.

Using the Internet is a completely different ballgame, because the Net couldn't care less how far your call travels. Everything is taken care of by the ISP and the global network. Once a call is rerouted to the ISP, special compression software converts voice into data packets that are then bounced through the Internet to their destination. No long-distance monopolies to contend with. And don't forget, the extreme scarcity of regulation on the Internet right now makes it a breeding ground for moneysaving schemes such as this. The two Internet/telephony hardware devices I found at Internet World are small, easy to use and lacking an inflated price tag. All you do is hook the box up to your phone and you're off and saving.

Little Boxes Of Heaven

Aplio is based in San Bruno, Calif., and makes what it calls the Aplio/Phone, which looks like a cross between a small, gray speaker and an answering machine. The other manufacturer is Santa Clara, Calif.-based **InnoMedia**. Its InfoTalk device is boxier than Aplio's creation and comes with a small, rectangular LCD on the front panel.

Both devices hook up to your phone just like an answering machine and cost $199.

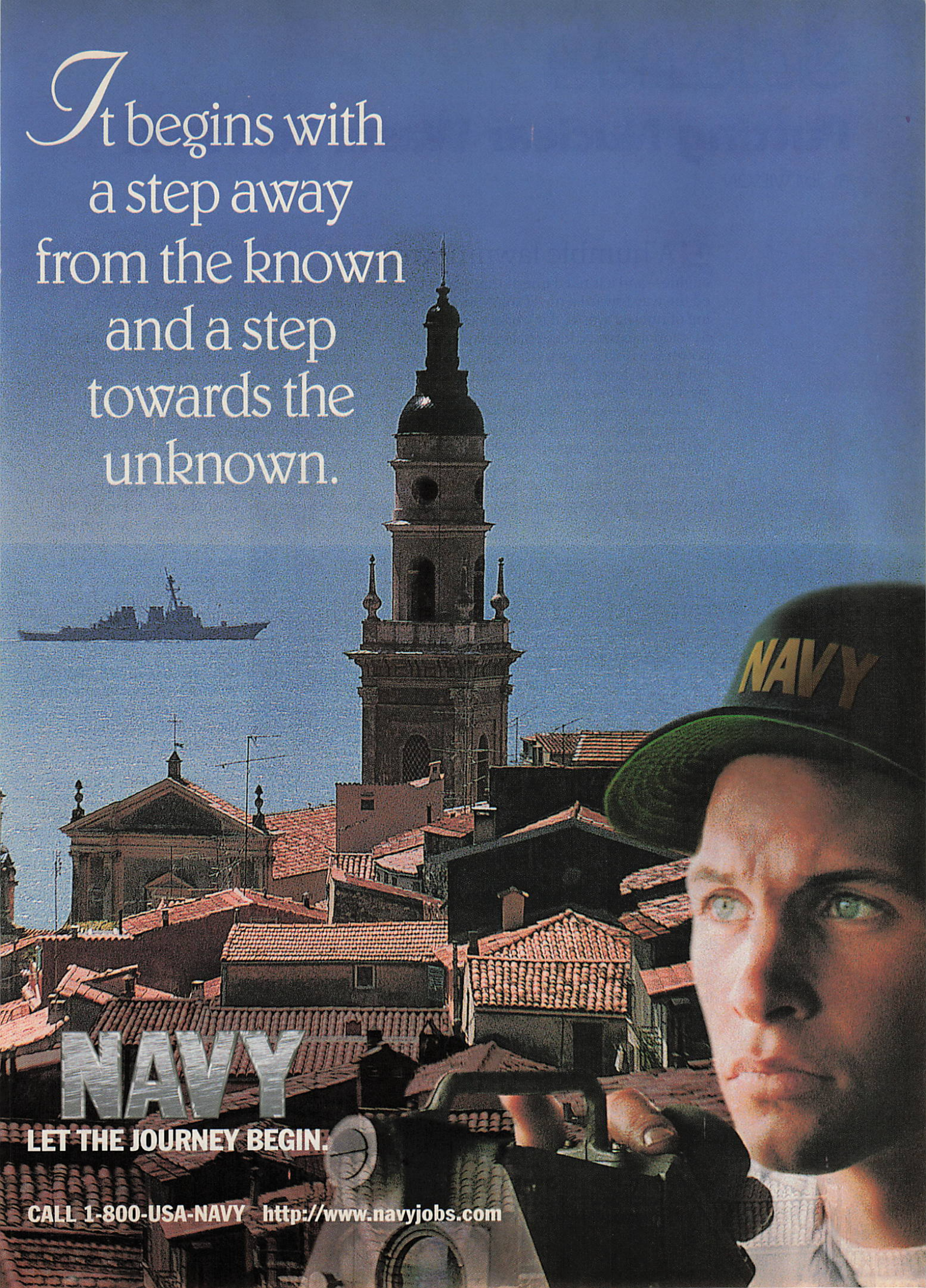
The main differences I could see in the two devices—other than appearance—is how you connect to your party. With the Aplio/Phone, you dial the number as usual, press the Aplio button in the middle of the device, and when your party answers on the other end, you both hang up the receiver. About 45 seconds later, the phone rings on both ends. Both of you pick it up and you're talking on the Internet with no long-distance charges.

So what's happening inside? When you press the Aplio button, each Aplio unit talks to the other by sending messages that are simply a series of beeps. The devices are then activated—and normal communication is cut. Each device then initiates a call to its local ISP. When both units are connected to the Internet, they retrieve each other through a meeting server at the ISP. When communication is reestablished, the phone rings on both ends by initiating another series of codes. To purchase an Aplio/Phone, you can check out the company's Web site at **http://www.aplio.com**, where you can order as many devices as you'd like and have them shipped anywhere in the world—or call 1-888-OH-APLIO for more information. Both Best Buy and Staples should have them in stock by the time this is printed.

InfoTalk works in almost the same manner, but after you make the initial call you tell your party to hold on instead of hanging up the phone. You then press the pound key on your phone's keypad and listen to a series of musical tones. Within 2 minutes, you're connected. The average time to connect is 45 seconds, but if there's traffic on the Internet, it could take longer. InfoTalk is now available at Fry's Electronics and TechData.

All But The Big One

Interestingly enough, any ISP will work with these devices with one exception—America Online (AOL). Although it's one of the biggest ISPs in the nation, its infrastructure is proprietary. In fact, no current Internet appliance will work with AOL. Both Aplio and InnoMedia believe that AOL will change its infrastructure in the next year to accommodate this new family of devices. **PM**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Science

Putting Nuclear Waste To Work

BY JIM WILSON

A humble lawnmower engine—and a junked one at that—has pointed the way toward a novel solution for disposing of nuclear waste. If it works as well as its developer expects, it might even turn nuclear power into an energy source an environmentalist could love. Okay, maybe not love, but at least learn to live with.

The idea revolves—literally—around a new type of reactor. Called a Nuclear Powered Turbo-Reciprocating Engine (NPTRE), it runs on a mix of "fresh" and "spent" nuclear fuel. The NPTRE is the brainchild of Claudio Filippone, an electrical engineer who, after working with leading automakers, started on a new tack by enrolling in the University of Maryland's graduate program in nuclear engineering. Before long, he decided that the familiar piston engine just might hold the key to safely disposing of the world's growing stockpiles of radioactive waste.

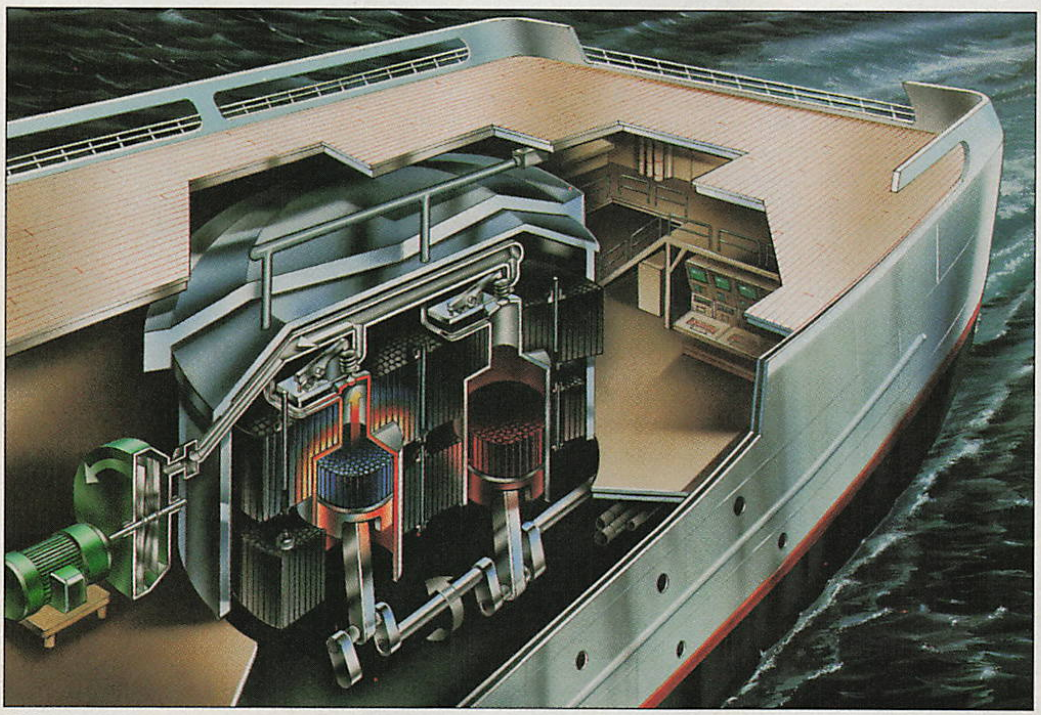


ILLUSTRATION BY PAUL DIMARE

Ships and power plants are natural applications for the NPTRE.

There are several types of radioactive waste, ranging from gloves worn by nuclear medicine technicians to underground tanks bubbling with millions of gallons of lethal leftovers from the Manhattan Project and Cold War bomb-building. But the big problem, both in terms of waste volume and radioactive content, is created by the fuel removed from commercial power plants when they are shut down for refueling once every 18 to 24 months (the refueling cycle for nuclear submarines is more frequent). Each time this is done, a portion of the nuclear fuel in the core of the reactor is removed and placed in a "spent fuel pool" near the reactor.

Fresh reactor fuel contains mostly natural uranium (U-238), enriched with between 2% and 4% neutron-emitting U-235 uranium isotope. "The splitting of the U-235 and U-238 produces fission fragments which will transform their kinetic energy into heat and continue decaying through radioactive processes," explains Filippone.

Depending upon the power-plant design, the heat created in the fissioning chain reaction produces steam or boiling water, which in turn drives a turbine connected to electric generators. The fission fragments, although radioactive, produce too few fast-moving neutrons to continue to support fission. When this happens, the fuel is considered spent—even though it still contains a large amount of U-238.

Because some of the material in spent fuel remains radioactive for thousands of years and can also be used in making nuclear weapons, the law requires that spent fuel be stored in a permanent repository. By 2020, the Department of Energy estimates, 85,000 tons of spent fuel will have accumulated. A repository to hold it still hasn't opened, so it is backing up in the local pools.

This is where the NPTRE comes in. It would allow fuel to remain in nuclear plants, where the radiation it releases can be put to work. The NPTRE's basic mechanical operation would be familiar to anyone who has changed a lawnmower spark plug. In the NPTRE, the piston is pushed by a small volume of liquid water that is quickly converted—flashed—into a large amount of superheated steam. This phase change occurs when the piston is at top dead center (TDC) and immediately after liquid water has been squirted into a specially shaped heat cavity. The steam, which now occupies more volume due to its expan-

sion, drives the piston down.

Heat to flash the water into steam is produced by a nuclear reaction that begins when a small amount of U-235 embedded in the piston enters a section of the reactor surrounding the cylinder head.

The NPTRE actually is made of two reactors placed one on top of the other. The one that influences the piston when it is at TDC creates a chain reaction that takes place in "new"—U-235-enriched—fuel surrounded by a water-moderated reactor, the top reactor. The moderator slows the neutrons coming off the piston and the surrounding cylinder, so they can be captured, and absorbed, by uranium atoms, which then split apart to sustain the chain reaction.

As the piston travels down the cylinder, it exits the water-moderated reactor and enters a second reactor. This one is filled with spent—U-235-depleted—fuel moderated by graphite. Graphite has special neutron-scattering characteristics that make a sustained nuclear chain reaction *almost* possible in the spent fuel. "However, by itself, the spent fuel and graphite combination cannot sustain a usable fission reaction," explains Filippone. "They need a little something extra."

That something extra comes in the form of neutrons emitted from the radioactive piston. As it approaches bottom dead center (BDC), it adds enough neutrons to support a pulsed chain reaction in the lower reactor. It produces a small amount of additional heat, which can be circulated through a heat exchanger or directly into the top reactor, and later used to spin a turbine.

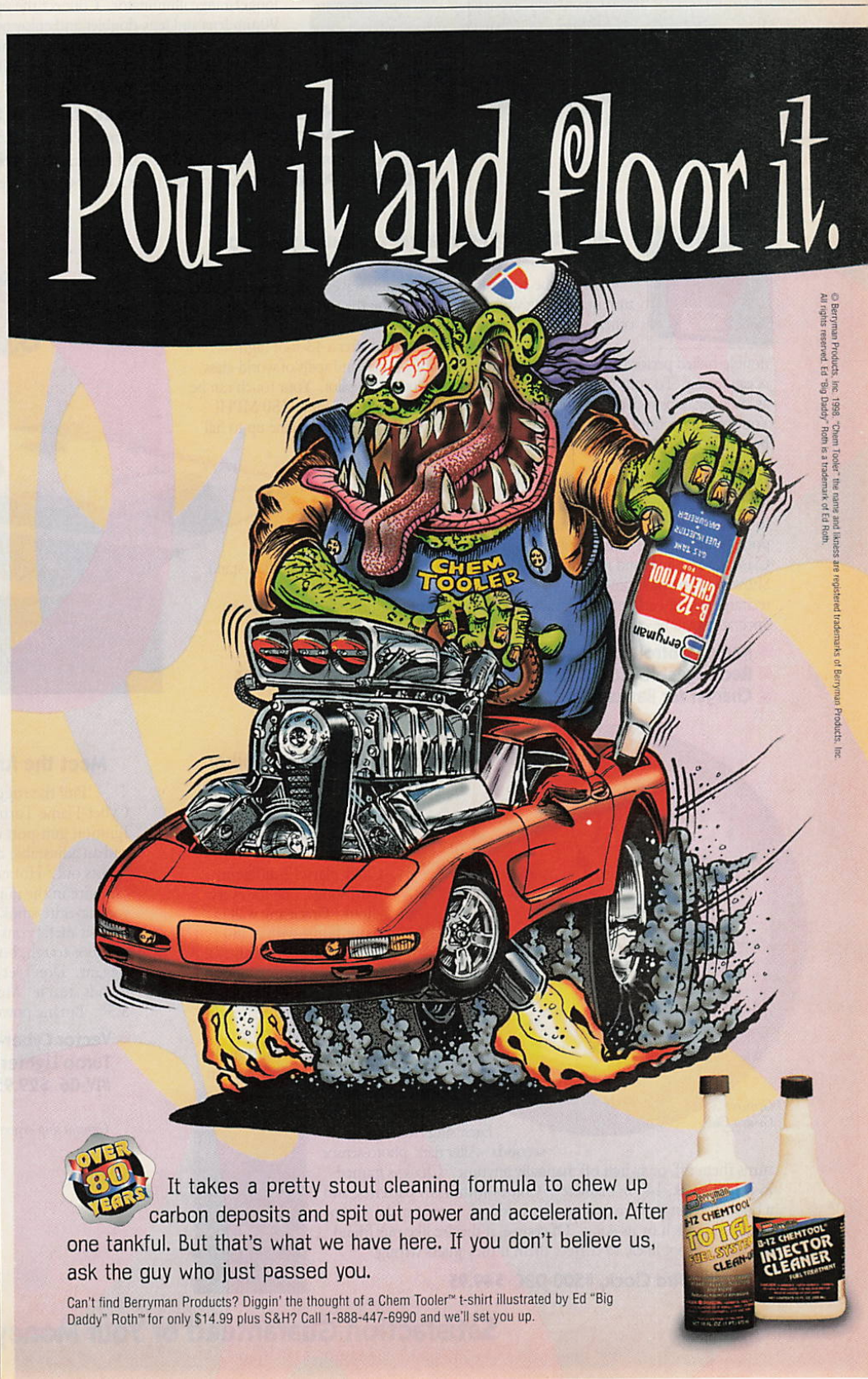
Nothing lasts forever. Eventually, the amount of U-235 in the piston decreases to the point where it produces an insufficient number of neutrons to continue the chain reaction. "However, we're talking about extending the lifetime of the fuel and its permanence in the reactor-shielded environment, perhaps as many as four to seven times longer than the current utilization," says Filippone.

And that's not all. When all of the heat and motion is accounted for, the NPTRE will achieve a thermal efficiency of 56%. By comparison, a conventional reactor operates with a thermal efficiency of 30% to 33%.

Filippone is confident about the system's high efficiency because in order to convince his Ph.D. committee that his idea would work he built a prototype. The piston and cylinder were scavenged from a junked lawnmower engine, and the high-pressure water injector is a modified 8-cylinder Oldsmobile diesel pump.

To simulate the heat released when the piston reached TDC, he used a heating element and a fast-switching electric power supply. The prototype worked and he received his doctorate. Looking at Filippone's handiwork, a member of his dissertation committee remarked that the NPTRE looked like something out of the pages of POPULAR MECHANICS—which of course it now is.

Although the Department of Energy has expressed interest in funding more research, Filippone is realistic about NPTRE's prospects. However, he believes that even if no NPTRE is ever built, the research that went into the project will produce dividends. The heart of the system—the intricate heat cavity that flashes water into steam—can coax higher efficiency from any type of heat engine. Including those that just putter along, cutting grass. **PM**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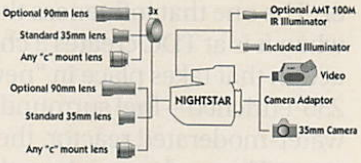

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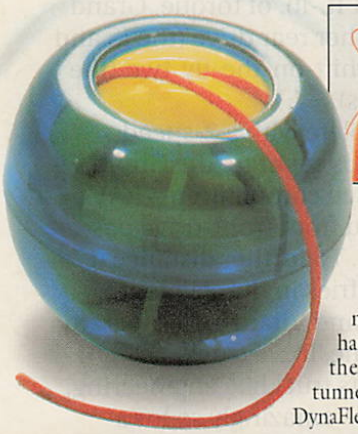
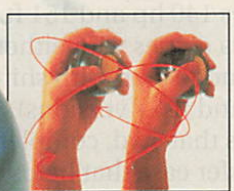
Translight Laser Art Pointer, #TI-333-8 $39.95

Diodes light up when in use.

Lady, skull, arrow, dot and two others–all in one! Arrow and dot excellent for instruction, job sites, or driving your pets crazy.



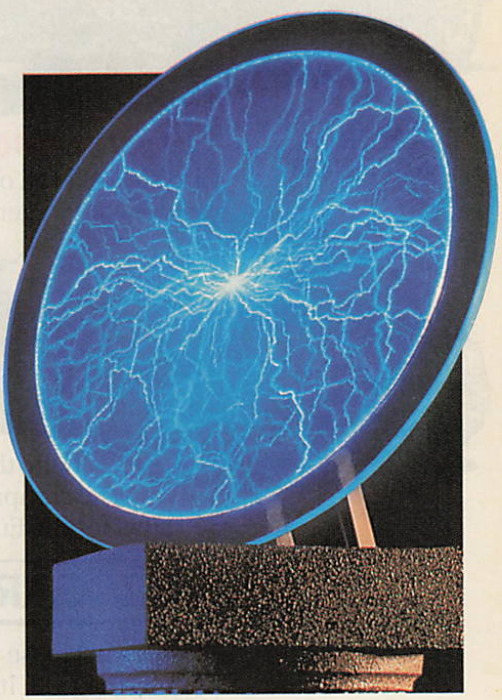


NEW DYNAFLEX STRENGTH MACHINE.

Powers up with the rising pitch of an F-18 fighter – with no batteries, no motor. Yet we dare you to hold on to it!

Give it a quick pull or thumb flick to get it moving. Rotate your hand. It starts to race and hum. Soon its whirling at over 9,000 revolutions per minute! Meanwhile, your wrists, grip, and arm are straining and working out against a powerhouse gyroscopic action. In fact, Dynaflex is now spinning internally so fast that it wants to leap out of your hand! Need a break? Pass it to an unsuspecting friend. Watch them try to hold onto it! As an executive relaxer, a carpal-tunnel/arthritis reliever, or a strength and coordination builder, DynaFlex will knock your socks off!

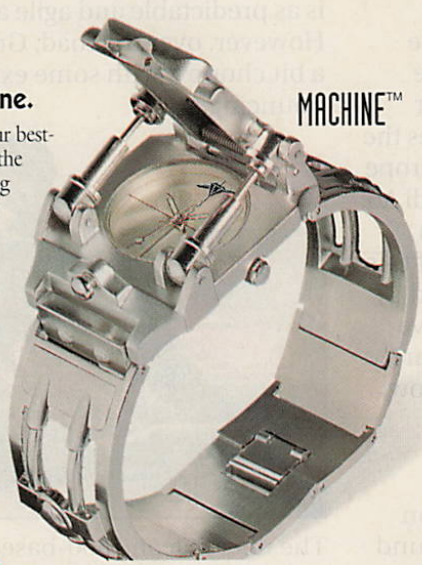
DynaFlex Strength Machine, #DF-1000 $21.95
The Ultimate Challenge – try holding two! #DF-PAIR $34.90 Save $9.00.



Welcome to the machine.

To access the time on our best-selling Machine Watch, touch the secret release button. Gleaming pistons push and slide, and the cover raises. Click it closed, and it's protected from dust and impact. Quartz action is ultra accurate. Wear it and enjoy the compliments you'll receive – from men, women, and any cyborg you meet.

Machine Watch III, #0340-M $39.95



Summon the forces of nature.

Sizzling bolts race and twist. Each zapping a new neon-blue path. Watch it from afar, or let your fingers create entire symphonies of light. Even your voice or stereo will shape pulsing lightstorms. Introducing the Luminglass. Like a seductive door to another realm, relaxing you, exciting your imagination, and amazing your visitors. Designed by electronic sculpture artist W. Strattman, you may have seen the first one in the film Star Trek™ First Contact. Sealed between three glass plates are rareified gases, electrons, and glass beads, fused at over 1500°. Lay back and watch it move to music, click a switch and freeze the action, or move your hand and trace a fiery visual maelstrom. AC powered, just plug it in. Knobs adjust speed and intensity. There is nothing like it in this world or any other.

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Automotive

Reports From Around The World

PHOTO BY BILL DELANEY

CHRYSLER LHS AND 300M

Chrysler 300M and LHS

Chrysler will roll out two high-style, 5-passenger, top-of-the-line sedans this spring when the 300M and LHS 4-doors appear in dealers' showrooms. They carry the same 253-hp, 3.5-liter V6 and 4-speed automatic transmission, and share essentially the same platform.

The company resurrects its legendary 300 label for the European flavor of the two models. Shorter in length by 10 in., the 300M has the same 113-in. wheelbase and 61.9/61.6 front/rear track as the LHS. Its shorter length qualifies the 300M as a "5-meter" car that can sell in Europe against such cars as BMW 5 Series and Audi A6.

NEW CARS

The flagship of the 1999 Chrysler sedan lineup is the luxury-directed LHS. Nine of this car's additional 10 in. of length, compared with the 300M, are in the rear. A short drive reveals a smooth drivetrain with quick, barely perceptible shift points. Noise levels are low, falling in the luxury sedan class even at speeds over 100 mph.

Both cars offer luxurious interiors with leather-trimmed seats, wood-grain trim on the instrument panel and doors, and a round analog clock.

—Jim Dunne

PHOTO BY BILL DELANEY

1999 SUZUKI GRAND VITARA

1999 Suzuki Grand Vitara

Before Toyota was selling RAV4s and before Honda was selling CR-Vs, Suzuki was busily selling mini-SUVs. To help keep up with its big-name competition, Suzuki is introducing an all-new vehicle to replace its current entry, the Sidekick. And along with the new engine, new body and new frame comes a new name, Grand Vitara.

Grand Vitara is actually the first of a new line of mini-SUVs from Suzuki, all to be called Vitara. Grand Vitara is also the first V6 Suzuki. Available with a manual 5-speed or optional 4-speed automatic, the 2.5-liter dohc V6 produces 140 hp and 151 ft.-lb. of torque. Grand Vitara comes with either rear drive (the JS and JS+ models) or with shift-on-the-fly 4wd (the JLX and JLX+ versions).

It's that 4wd, complete with a 2-speed transfer case that helps separate the Grand Vitara from the car-based competition—RAV4 and CR-V are adapted from front-drive passenger-car platforms. To further distance it from the other small fries in the segment, Suzuki is building Grand Vitara on a separate ladder-type steel frame, like a truck.

However, despite its trucklike engineering, Grand Vitara is quiet—amazingly so for a small, relatively inexpensive SUV. The drivetrain is smooth and willing, and the handling is as predictable and agile as its competition's. However, over the road, Grand Vitara's ride is a bit choppy, with some extra bobbing and bouncing.

—Don Chaikin

Kawasaki Nomad

The new Vulcan 1500-based Nomad has huge, lockable hard saddlebags, a new seat location, relocated footboards, one muffler per side, an adjustable windshield with a 2-in. range, lower windscreens, and more comfortable control levers for the front brake and clutch. Even more basic than these improvements are the new, upsized frame, a second disc brake for the front wheel and larger rear disc, larger 150/80-16 tubeless tires on cast 5-spoke wheels, and a new 5-speed transmission.

There are a number of engine revisions to what is already the biggest V-twin engine in the business. There's a larger air-induction

(Please turn to page 60)

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tract, a bigger radiator, a new carburetor with a throttle position sensor that controls ignition timing, and a carburetor heater for improved cold-weather response.

We rode the new Nomad on a wandering trip around Florida from Tampa to Orlando to St. Augustine and Daytona, including a day of riding in the rain, and came away impressed. The engine is smooth (it has a gear-driven balance shaft), the shifting precise, and the torque plentiful—83 ft.-lb. at 3000 rpm. Fit and finish are superb. For a dollar less than $12,000, this is one of the most comfortable cruisers out there. *—Jim McCraw*

DETROIT SPY REPORT

BY JIM DUNNE

2000 Lincoln LS6/8

LINCOLN LS6/8

Lincoln will introduce its new 5-passenger sedan next spring as an entry into the growing luxury/performance sedan market. Two distinct models will be offered in the United States, the LS6 powered by a V6 engine and the LS8 with a V8 engine. Prices will range from the low 30s to about $40,000 depending on engine type and option choices. Lincoln insiders make no excuses for the obvious similarities in size, power, weight, passenger capacity and price between this model and the BMW 5 Series. Ford will sell the car in Europe as its flagship there, offering both righthand- and lefthand-drive models.

We can tell you that the car is 194 in. long and sits on a 114½-in. wheelbase. The rear-drive platform will be powered by either a 3.0-liter V6 or 3.9-liter V8. A 5-speed automatic will be available with either engine, while the V6 can be mated to a 5-speed manual. Among other engineering features, the car will offer 4-wheel-disc ABS, yaw and traction control, and front-seat side-impact airbags. Lincoln plans to start production of the LS6/8 early next year, with showroom deliveries slated for spring 1999.

2000 Ford Monster Truck

PHOTO BY JIM DUNNE

FORD MONSTER TRUCK

Ford will introduce a sport/utility version of its F-250/350 truck as a 1999 model. This gargantuan SUV will be larger than the Expedition. Since the new truck is based on heavy-duty pickups and the Expedition is based on the smaller F-150, Ford envisions the vehicle as "a cavernous utility wagon offering the roominess and comfort of a luxury car." Engines will be large: the 5.4-liter V8, 6.8-liter V10 and 7.3-liter diesel. Flexible seating will hold a maximum of nine and there will be plenty of room for storing gear. Three trim levels will be offered, the XL, XLT and Premium, with Premium including leather seats and wood trim inside. Look for a price in the mid-$40,000 range. Name? One being pondered is Excursion.

1999 Ford Mustang

The original ponycar is due for a complete front- and rear-end changeover. The modifications are subtle, but Mustang owners will spot them immediately. A new nonmetal hood has a horizontal air scoop at the rear of a trough that runs through the center of the hood. This inlet replaces the dual air intakes of the SVT Mustang Cobra. The conventional grille opening is wider and more defined than on the current model. A definition line runs along the top of each front fender. On current models this line is slightly below the crown of the fender. Most noticeable is the angular shape of the headlights that cut back into the fenders. Front fascias will have a continuous surface from side to side in place of the flat space now provided for the license plate. At the sides, a new slanted line moves rearward from the front of the door to a large, nearly vertical crease. Overall the new look is one of a larger, more muscular vehicle with the emphasis on a broad front end that carries rearward through the door and quarter panel.

PHOTO BY JIM DUNNE

1999½ Chevrolet Monte Carlo

Chevy's coming Monte Carlo coupe will be larger than the current model when it is intro-

(Please turn to page 62)

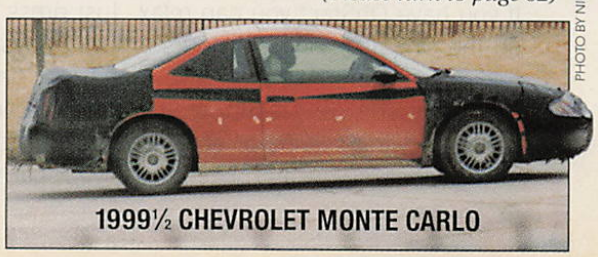
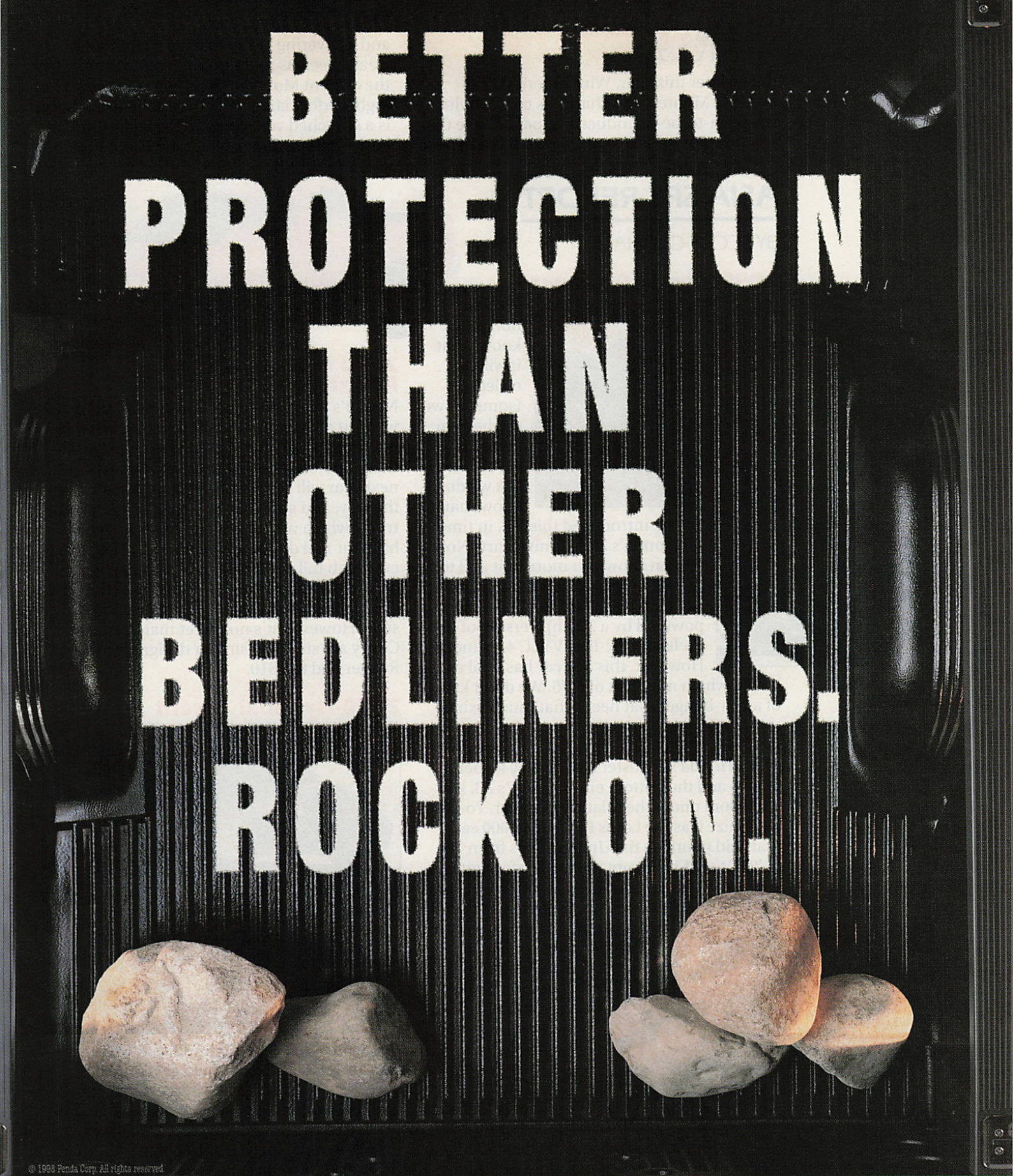


PHOTO BY NICHOLAS A. TWORK

1999½ CHEVROLET MONTE CARLO



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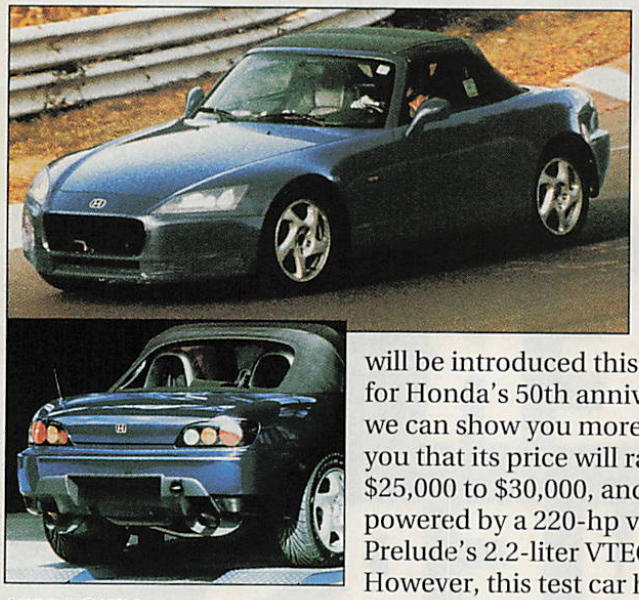
duced later this year. Why larger? Mainly because Monte Carlo shares its chassis with the soon-to-be-introduced Impala. While the spied prototype is disguised with a bra in front and a covering at the rear, its overall shape is clearly seen as more rounded, more bulky than the current Monte's. Front-wheel drive and a high-performance V6 will be standard. This car is a stretched version of GM's W platform, the basic building block for Grand Prix coupe.

ASIA SPY REPORT

BY SCOTT OLDHAM

1999 Honda Roadster



HIDDEN IMAGE PHOTOS

1999 HONDA ROADSTER

We still don't know what it will be called (some, as we did back in February, say the SSX), but we do know that it will be introduced this fall, in time for Honda's 50th anniversary. Now we can show you more of it and tell you that its price will range from $25,000 to $30,000, and it will be powered by a 220-hp version of the Prelude's 2.2-liter VTEC 4-cylinder. However, this test car has dual exhaust, which may hint of a V6. We don't know of any 4-banger that needs that much exhale.

2000 Kia Elan

While Honda's roadster battles fully loaded Miatas and the bottom end of BMW's Z3, Kia sees room under the Miata for this car. You'll recognize it as the Lotus Elan, a $40,000 car that sold poorly in the United States from '89 to '93. Well, Kia bought the tooling for that car, and planned on marketing it in Korea for about $30,000. Then the Korean economy went south quicker than an aspiring Winston Cup driver. So the car Kia has said won't come to the United States probably will, with a price under $20,000. That puts it under the base price of the new '99 Miata. The Elan, which may get a new name, will be sold in low volumes, about 150 a month, simply because Kia will probably lose money on each unit. The 2355-pound car is front-drive, has a 5-speed manual transmission and is powered by a 151-hp 1.8-liter dohc 4-cylinder. It will run 0 to 60 in 8.7 seconds, about half a second slower than the Mazda.

PHOTOS BY LES BIDRAWN

KIA ELAN

2000 4-Door Nissan Frontier

Nissan's new '98 Frontier pickup debuted without a V6, without a third door, and without much of a debut. Sales have been weaker than the Korean economy. But Nissan hopes next year will be different, because a V6 is on the way, and so is this cool 4-door model. This truck, which will be built in Smyrna, Tenn., has four real doors, and a real back seat, like a crew-cab full-size truck. If Nissan can get the 4-door to market quickly, it will have the only compact pickup available in such a body style. However, it's no secret that Ford and Chevy are studying similar designs for the Ranger and the S10.

2000 Hyundai Accent

2000 HYUNDAI ACCENT

HIDDEN IMAGE PHOTOS

Being the entry-level Hyundai can't be easy—I mean, Rodney Dangerfield gets more respect. But recently the Hyundai Accent got a market segment almost all to itself when the Ford Aspire died and Toyota's Tercel was muscled out of the way by its bigger brother, the Corolla. So Hyundai is taking action, and redesigning the Accent for the 2000 model year. Less sporty-looking than the present model, the '00 model has some Corolla in its upright shape and that character line that runs from stem to stern. The 1.5-liter engine will get a few more horsepower, bumping the present car's 92 ponies up to an even 100. And a 2-door will be offered. PM

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It's a fact that may come as news to many people, and often too late: Only flood insurance covers floods. Available through your insurance agent, it's the best way to protect your home and family when flood damage occurs. And compared to going into debt or having to qualify for disaster relief, the cost of flood insurance is a drop in the bucket.

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If you don't live near water or live on a hill and believe you're safe from floods, just listen to the news. Experts report that weather patterns are changing fast–and so are your chances of being flooded.

In fact, last year, two out of three federally declared disasters were flood related. And what's more, 25% of all flood claims came from areas no one considered high risk.

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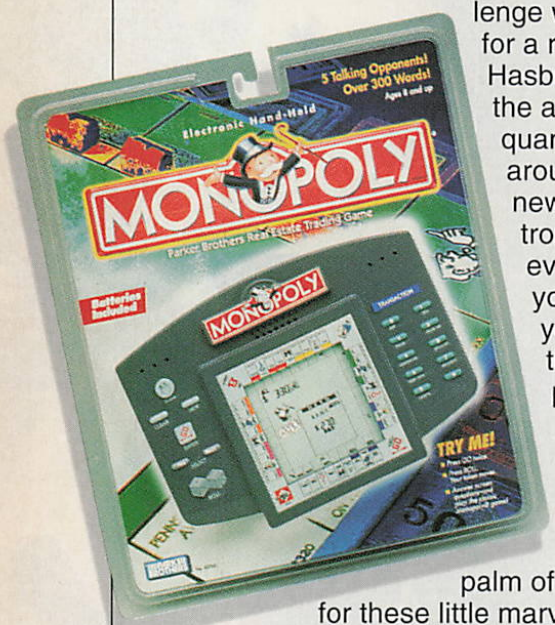
Are We There Yet?

These are words we all get used to during the summer months. Packing up the family and getting kids to sit still for more than 2 hours can be a real challenge when heading out for a relaxing holiday. Hasbro thinks it has the answer to this quandary. Try toting around some of the new handheld electronic games to keep everybody busy while you're traveling to your favorite vacation spot. New products include such favorites as Monopoly, Candyland and Trivial Pursuit—all of which fit in the palm of your hand. Look for these little marvels in any retail store that carries electronic games. Both Monopoly and Trivial Pursuit are priced at $24.99, while Candyland can be purchased for $19.99. Contact Hasbro Inc., 1027 Newport Ave., P.O. Box 1059, Pawtucket, RI 02862; 401/431-8697.

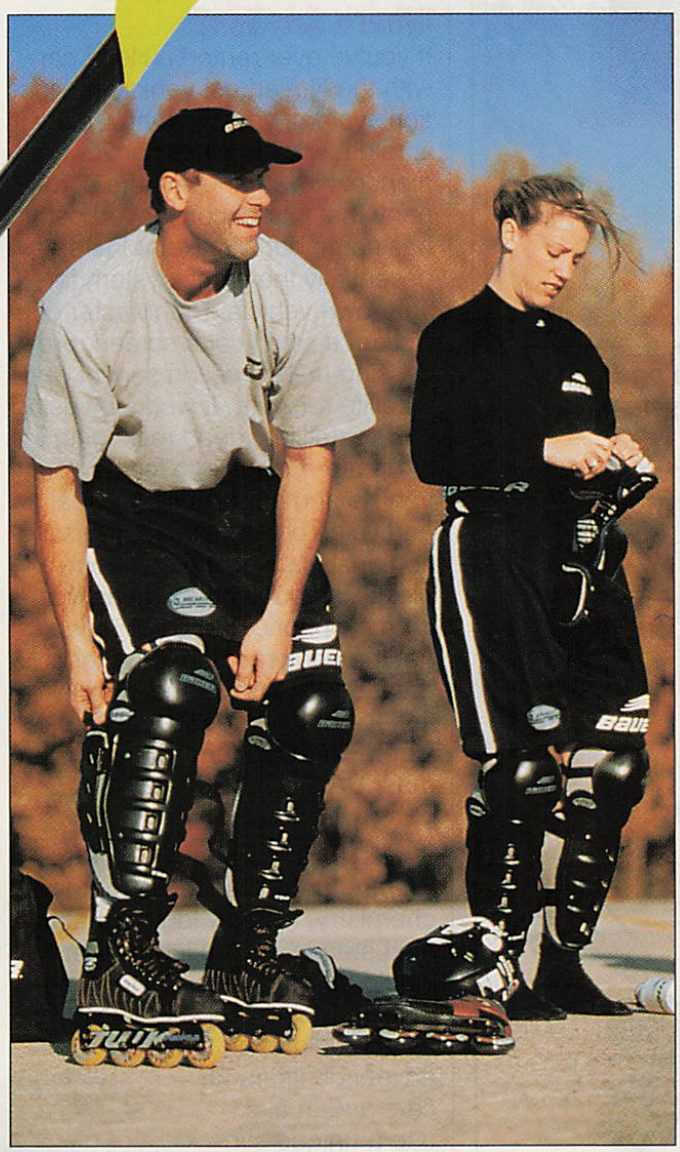


It's Time

This seems like an idea whose time has come: an electric string trimmer that eliminates the hassle associated with tangled trimmer line by using a snap-on line head. McCulloch developed the product with engineering powerhouse Battelle Laboratories. Each line head consists of a disc with three or six lines mounted in it, in diameters from 8 to 14 in. Each trimmer comes with three heads, and replacement heads are available at the same retailers where the trimmers are sold. When the lines on the head are worn, press a button to release it, snap on the new head and seconds later you can keep cutting. Several models are offered in the product line, and the line head for each is color-coded to the trimmer. We show the 3600 TE, a convertible trimmer with a 12-in.-dia. head and a 5.5-amp motor. Press a button to adjust the machine's shaft length or to rotate the shaft 180° so it can be used as an edger. The trimmer costs about $50 at Sears, home centers and discount retail stores. Contact McCulloch, 6085 S. McCulloch Dr., Tucson, AZ 85706; 800-423-6302.

That's Entertainment

Short of a straitjacket, the next best thing to control the kiddies is the Flexvision system, with its 6.4-in. flip-down LCD monitor for minivans and sport/utilities. Choose among TV, movies, videogames and even your video camera shots as you roll into the sunset. All the hardware comes in an overhead-mounted pod. The Flexvision entertainment system is available at mobile-electronics outlets for $1499. Contact Audiovox Specialized Applications, 23319 Cooper Dr., Elkhart, IN 46514; 800-688-3135.



And Carry A Big Stick

There are two musts for serious roller hockey players. The first is to wear padding.

Luckily, Bauer, the first name in hockey equipment, has come out with a line of protective gear made especially for rolling Gretzkys. Adapted from the company's NHL-proven line of ice hockey accessories, the collection includes gloves ($120), pants ($55), shin guards ($70) and shoulder and elbow pads ($70, $60).

The gear, which is available in sporting goods stores, features extra padding in high-contact areas, ergonomic design for secure fit, and high-tech fabrics that ventilate and wick away moisture.

Contact Bauer, 150 Ocean Rd., Greenland, NH 03840; 603/430-2111; fax: 603/430-3010.

Fast Tracker

If on-road comfort, performance and handling from your sport/utility is more important to you than trying to outrun mountain goats or grinding through door-handle-deep mud, Pirelli has a tire for you. The Scorpion Zero low-profile tire for SUVs and light trucks carries V and H speed ratings and fits rim diameters of 15 to 19 in. The tires offer outstanding steering and braking response, especially in the wet. They're sold at authorized Pirelli dealers, and cost $150 to $300 each. Contact Pirelli Tire North America, 500 Sargent Dr., New Haven, CT 06536; 800-327-2442.

Serious Kicker

How can a boater increase thrust without adding more horsepower? Get a Mercury/Mariner Bigfoot outboard. These engines feature larger, heavy-duty gearcases and higher gear ratios, which means they can turn larger-diameter props. That translates into up to 20% more thrust, 15% better fuel economy and improved maneuverability.

The extra low-range to midrange power of Mariner's new 25-hp 4-stroke Bigfoot makes it a great kicker for trolling. With a pull start, it's available for about $2900 from Mercury/Mariner dealers. Contact Mercury, P.O. Box 1939, Fond du Lac, WI 54936; 920/929-5000.

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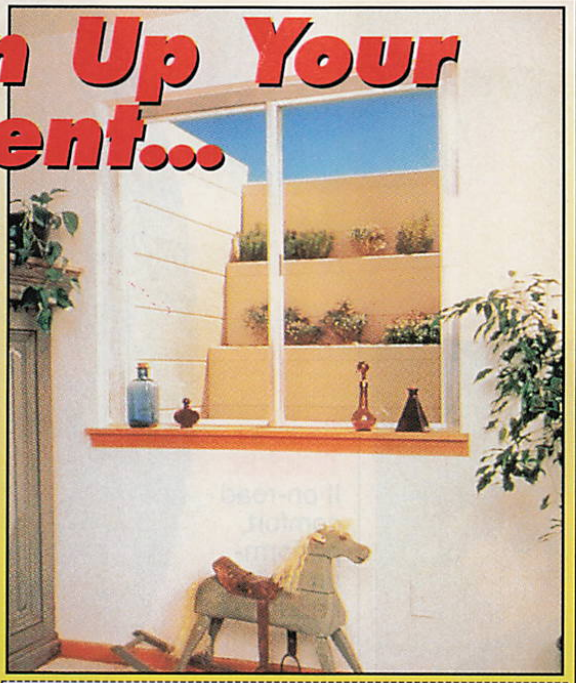

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If you've ever rented a Hertz car with the NeverLost vehicle navigation system, you know how easy it is to get spoiled by its convenience. Now Magellan, the company that introduced NeverLost, has come out with PathMaster—essentially the same system for your own vehicle. PathMaster consists of a small color screen, processing unit, direction sensor and satellite receiver. It works by using GPS satellites, dead reckoning and map-matching to locate your vehicle and guide you by visual and voice prompts to your destination. Installation time and complexity is about the same as that for a cellphone. For $1995, you get the equipment, one regional database cartridge and installation. Contact Magellan Systems Corp., 960 Overland Ct., San Dimas, CA 91773; 800-823-2547.

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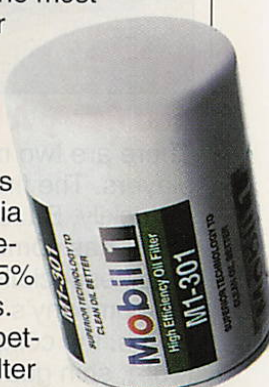
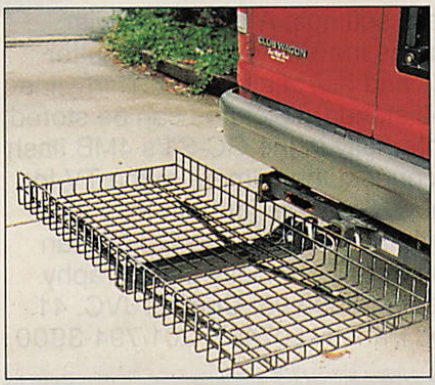


Well Scrubbed

The great outdoors might not seem so great when there's cleaning to be done. That's when Black & Decker's Scumbuster is designed to step in and make an unpleasant chore much easier. The 7.2v cordless tool is water-immersible and its brass bristle brush, wide synthetic brush and scrubbing pad are intended to scrub anything from a barbecue grill to rusty metal. The tool's single battery provides 20 to 25 minutes of run time on a charge. With one rechargeable battery and charger, it costs about $50 to $60 at home centers.The product comes with the plastic caddy shown. For more information, contact

Black & Decker, U.S. Household Products Group, 6 Armstrong Rd., Shelton, CT 06484.



You *Can* Take It With You

When you've packed your sport/ute or pickup to the point where the body panels are about to pop, but the little lady wants to haul "a few more things" to the family picnic, it's time to break out the Hitch Carry-All basket. Unlike similar products that also fit into your Class II or Class III receiver, this basket folds up easily when not in use. Measuring 52 in. long × 24 in. wide × 4 in. deep, the 42-pound basket will haul up to 500 pounds, or more than enough hot dogs for a family of six. The unit is constructed of 1/4-in. steel rod, welded at every joint and powder-coated. The basket costs $149 from Marketing Distribution Inc., 228 Johnston Sq., Rock Hill, SC 29730; 888-856-2364.

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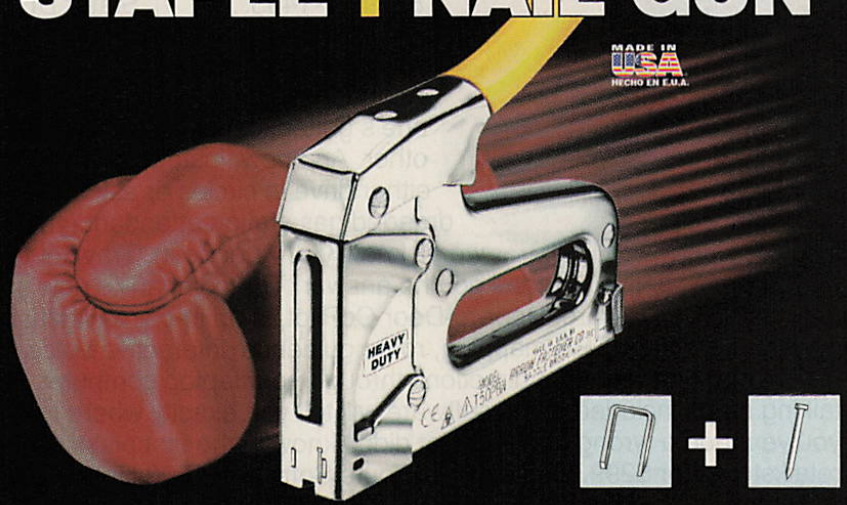

It Packs A *One-Two* Punch

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ARROW tools and supplies are available at home centers, lumberyards and hardware stores.

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- **ARROW T50PBN. Solid. Reliable.** Perfect for the handyman, the professional, and the hobbyist. *You work hard for your money, spend it wisely.*

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JARDEL DISTRIBUTORS, INC., 6505 METROPOLITAN BLVD. EAST, MONTREAL, QUEBEC H1P 1X9
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Great Stuff

At Your Disposal

Every time you use In-Sink-Erator's Septic Disposer, you automatically send a dose of liquid enzyme down the drain to attack the kitchen waste that the disposer just ground up. The enzyme is supplied by a 16-ounce cartridge that you press into place in the disposer's housing. The cartridge (about $9) should provide enough enzymes for four months of typical use, the company says. The ½-hp disposer costs about $180 at home centers. Replacement cartridges are sold at home centers and directly from the manufacturer. Contact In-Sink-Erator, 4700 21st St., Racine, WI 53406; 888-527-1493.

More Still

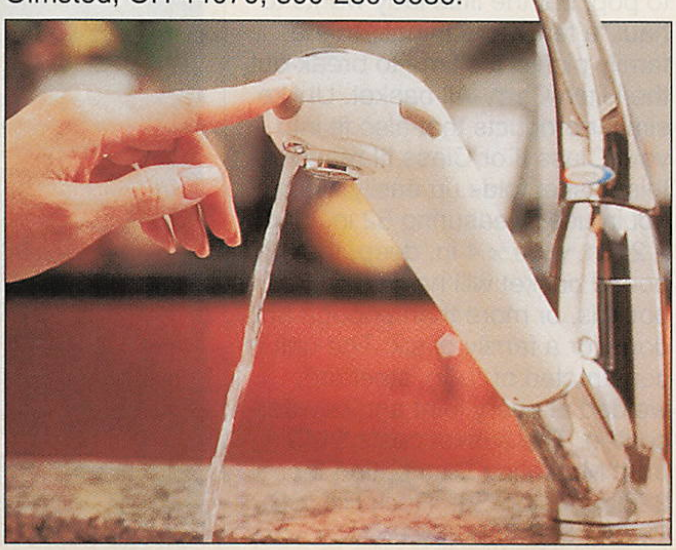
This compact, digital camera from JVC (its first) features a 10× optical zoom and wireless digital data transfer called IrTran-P infrared protocol. The GC-S1 has a 1.8-in. TFT color LCD monitor with adjustable brightness settings. A ¼-in. CCD with 350,000 pixels handles the VGA pictures. Shutter speed is between ⅛ and 1/1000 of a second. Thirty fine-mode pictures or 50 standard pictures can be stored as JPEG images internally in the GC-S1's 4MB flash memory. You can connect the camera to the TV for a futuristic slide show. Software for both PCs and Macs is bundled with the product. The GC-S1 can be found at electronics and specialty photography stores. Pricing is set at $699.95. Contact JVC, 41 Slater Dr., Elmwood Park, NJ 07407; 201/794-3900.

Make A Left Where?

Although we hate to admit it, everyone's gotten lost at one time or another. And now, instead of having to either drive in circles or ask the dreaded gas station attendant (yes, we all know you've done it), TravRoute has got the answer. The company's new software, Door-to-Door CoPilot, is an in-car navigation system that offers GPS mapping, route guidance, interactive voice technology and real-time directions through your laptop computer. The talking maps included in the software will tell you exactly where to go if you've made a wrong turn—or just didn't know in the first place. The software can be purchased at computer retail stores for $299. Contact TravRoute Software, 1000 Herrontown Rd., Princeton, NJ 08540; 609/252-8126.

Everything You Want

Moen's PureTouch appears to be everything you would want in your next kitchen faucet. It has a filter that's easy to change and a digital display powered by a watch battery that tells you the amount of life left in the filter. To run water through the filter, press the button at the top of the spout. No tools are required to change the filter. Twist the quarter-turn connector at the base of the pullout spout, remove the bottom panel, lift out the old filter, and snap in a new filter. Moen says the filters last three months under typical use. Three types of filter are available. One filter removes 93.3% of the chlorine, the next filter also removes 99.5% of any waterborne lead, and the top-level filter removes the previous two contaminants and 99.98% of the waterborne parasites cryptosporidium and giardia. The PureTouch costs about $450, and replacement filters are about $25 each. The products are sold at plumbing supply houses and kitchen-and-bath dealers. Contact Moen Inc., 25300 Al Moen Dr., North Olmsted, OH 44070; 800-289-6636.



Stable Vision

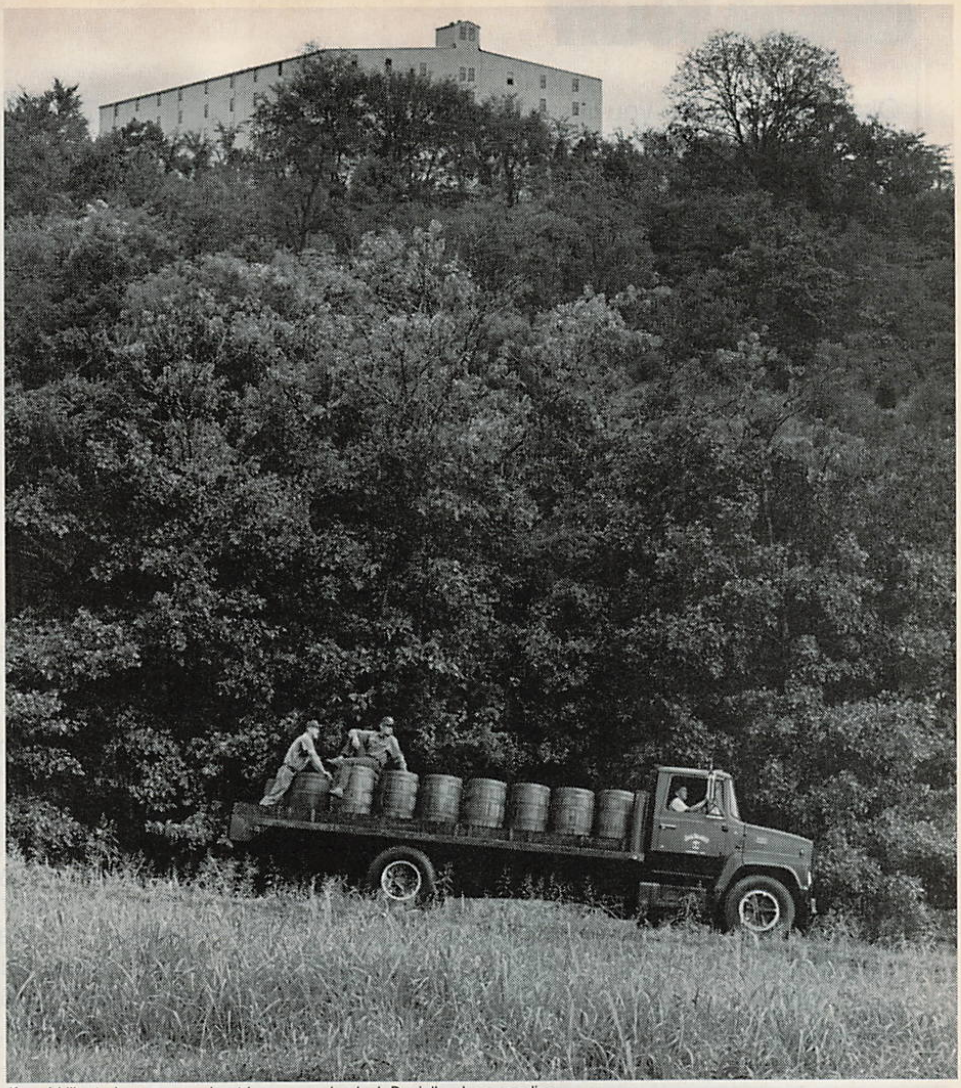
You don't realize how much your hands shake until you try to focus on a detailed object with a binocular. That's why someone invented the tripod. Now, Canon has gone one step further with its 10x30 IS Image Stabilizer model.

The glasses feature a vari-angle prism that uses two linked, flat glass plates in a special fluid-filled film to dampen vibration. The system compensates for everything from minor hand shake to the rattling of a bumpy car ride.

Without the two AA batteries, the porro-prism binocular only weighs 22 ounces. Coated lenses with individual diopter controls provide sharp images. You can find the 10x30 IS for about $800 in outdoor stores and specialty shops. Contact Canon, One Canon Plaza, Lake Success, NY 11042; 800-828-4040.

Gun It

This idea is so clever, we wish we thought of it: a drywall repair compound that you dispense with a caulk gun, reducing waste and mess in the process. Cut the tip to produce a bead of the desired diameter, run it over the crack or other surface imperfection, spread it with a drywall knife, and it's a wrap. A 10.5-ounce tube costs about $2 at hardware stores and home centers. Contact United States Gypsum Co., P.O. Box 806278, Chicago, IL 60680.



If you'd like to know more about how we make Jack Daniel's, drop us a line.

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Great Stuff

Crew Cut

Okay, just because you like cutting grass doesn't mean you want to spend all day at it. Simplicity's zero-turn riding mower is designed to leave a 38- or 44-in.-wide swath of neatly barbered grass in its wake while cutting so close to edges that you hardly need to trim. It's powered by a 14- or 16-hp engine and hydrostatic drive. A pair of hand levers controls its forward and backward motion. Two other nice features are its electric power takeoff and its ability to accept grass catchers from 6.5 to 17 bushels. The 14-hp model with a 38-in. deck costs about $3500 and the 16-hp model $4000. Both are sold at Simplicity dealers. Contact the company at 500 N. Spring St., P.O. Box 997, Port Washington, WI 53074.

High-Quality Home Printing

Xerox wants to make printing at home a much easier proposition. The company recently brought out its DocuPrint P12, which prints at a rate of 12 pages per minute with a 600 × 600 dots-per-inch resolution. It's just black-and-white—and perfect for a home office. The P12 incorporates Adobe PrintGear technology to help it run at its rated engine speed, and it comes with a 3-year warranty. A software bundle is included—so if you're in need of programs such as Lotus Organizer, McAfee VirusScan or Broderbund ClickArt, this may be for you. You'll find this product where home office products are sold for a suggested retail price of $699. Contact Xerox, Xerox Square 05C, Rochester, NY 14644; 716/423-5230.

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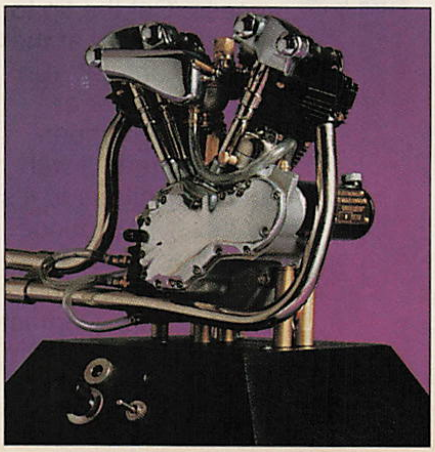
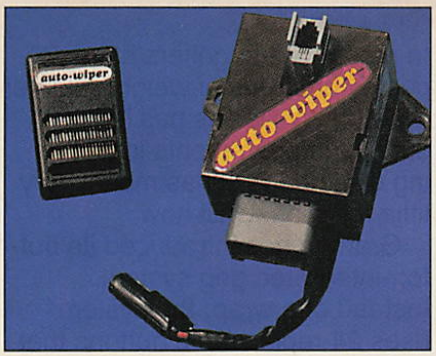
Looking for the ultimate desk ornament and conversation piece? Check out this ¼-scale, fully operational 1937 Knucklehead Harley-Davidson motorcycle engine. The spark-ignition engine is pressure lubricated and uses a built-in fuel pump. Its base contains a nickel-cadmium battery pack, starting motor, electronic ignition, two spark coils, oil tank and starter button. Ultimate *anythings* aren't cheap, and this engine is no exception at $3800. Add $125 for long exhaust pipes. Contact Double W Inc., Top O' The Lake Rd., Gulliver, MI 49840; 906/341-3561.





Class Wipe

Some new luxury cars now come with an automatic windshield wiper activation system that's triggered by the first peep of rain. Why not your old Yugo? The Rainswitch Auto-Wiper is an easy retrofit of your original wiper control module. The plug 'n' play connection does not change your factory wiring in applications for popular domestic and imported cars and trucks. A universal model for less popular vehicles requires some custom wiring. The Auto-Wiper sells for $199 direct from JKL Technology, 6100 Willow Pond Dr. N., Fredericksburg, VA 22407; 540/785-0515.

Thrifty

You're not going to find low-voltage lighting much thriftier than this device. It uses a 9-watt compact fluorescent bulb. The manufacturer says it produces about the same amount of light as a 35-watt bulb. The light's versatility and ease of installation is increased by a photosensor that switches the light on at dusk. An adjustable setting keeps the light on for 4 or 6 hours, or until dawn. It's called the Pagoda Garden Light, and a 4-light kit costs about $100 at home centers. Contact Alpan Inc., 425-I Constitution Ave., Dept. P, Camarillo, CA 93012; 800-243-8633.

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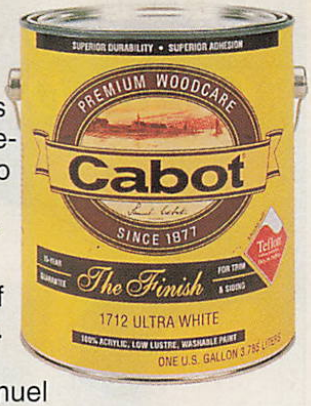
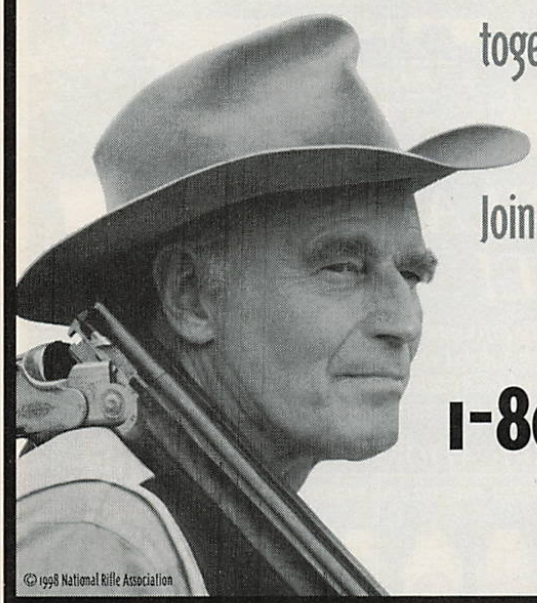
Race To The Finish



Cabot calls its new all-acrylic paint simply The Finish, and lists for it nearly every desirable attribute you could hope for in a paint. Cabot says the product will bond to nearly any surface material, and most of the time you don't even need to apply primer first, or sand to knock down the gloss. The coating has been formulated to offer the weather-resistance and hardness of traditional alkyd coatings while providing the ease of application and cleanup of a waterborne acrylic. The Teflon-containing paint costs about $25 a gallon at independent paint stores. Contact Samuel Cabot Inc., 100 Hale St., Newburyport, MA 01950; 800-877-8246.

There's a cultural war raging across America. Anti-gun media, politicians, educators and thought police are storming your values. Assaulting your freedoms. Killing your self-confidence. If you don't believe it, then **why do you tell your kids to keep quiet about daddy's guns?** Fight back. Arm yourself with the courage of your convictions. Be proud of who you are and what you believe. Only then and only together can we defy them and defend our way of life. Join Me. Join Us. **Join Today.**



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Get The Shaft

In recent years, golfers have become conscious of weight—lighter is better. While this has led to all sorts of improvements in designing club heads, it has meant very little for grips. Until now.

Graman has introduced its button-integrated grip system. Instead of a wrap, the system uses 24 replaceable buttons that attach directly to the shaft. Since the buttons are raised, they give your hands a secure grip during a swing. And all together the buttons weigh only 2 grams.

The button system comes on the new graphite button-integrated shafts, which sell for about $100 at pro shops and golf specialty stores. Contact Graman, 17654 Newhope St., Fountain Valley, CA 92708; 714/444-4114.

Think Again

SiteLight products are designed with ease of installation in mind. For example, the 120v lights tap into an exterior outlet by means of a power hook-up kit. The UL-listed kit allows you to tap the outlet by mounting a gasket-sealed junction box on top of it, and you run conduit from there. The lights are cast aluminum with shatterproof lenses. The post light and sconce cost about $25 each (not including the post), and the swivel wall light costs about $35. The products are sold at home centers and electrical supply houses. Contact L.E. Mason Co., 98 Business St., Boston, MA 02136; 800-356-2500.

Small, Yet Big

Ampro Corp. wants to make sure you get big quality in a small package. Its new LCD-160 compact projector is extremely light, weighing 15 pounds, and is meant to give you high-quality video and multimedia pictures. It's got 750 ANSI lumens and uses 2.3 million active pixels with 1024 × 768 LCD panels. The projector also includes power zoom and focus, volume, input and picture control. All these features are controlled with an IR remote mouse with laser pointer. Use the LCD-160 with almost any source, including videotape, DVD, laserdisc or camera. You can also use it for home computing, Internet browsing and videogames. The suggested retail price is $10,495. Look for it at high-end video retailers, or contact Ampro Corp., 5 Wheeling Ave., Woburn, MA 01801; 617/932-4800.

Wood You Like A Burger?

Wood pellets make a great heating fuel because they are compact and clean, but it may not be obvious to you that the same characteristics also make them well-suited as a barbecue fuel. The Nomad 2000 is a portable pellet-burning barbecue that weighs 45 pounds. Its pellet-loading auger is powered by a low-voltage AC/DC motor. Its transformer can plug into an outdoor outlet or, with its adapter, it can plug into a car's cigarette lighter. Lacking either, you can run the grill for about 5 hours by plugging a 12v Makita power tool battery into the grill's battery port. If that were not enough, you can run it for 3 hours using a 9.6v Makita battery (batteries not included). The Nomad's hopper accepts about 3 pounds of pellets, but 2 cups of pellets will provide the necessary heat to whip up a couple of burgers. It costs about $380 to $460 at barbecue specialty shops. Contact Reliant Industries, 333-3 Industrial Dr., Placerville, CA 95667.

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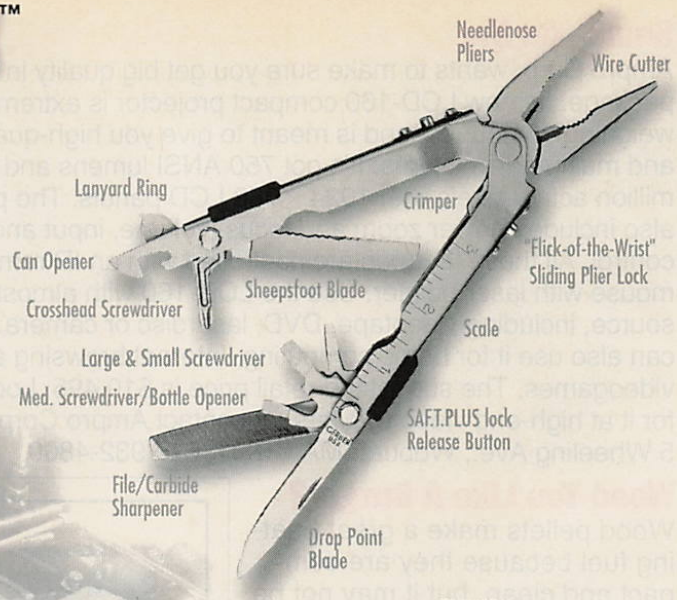

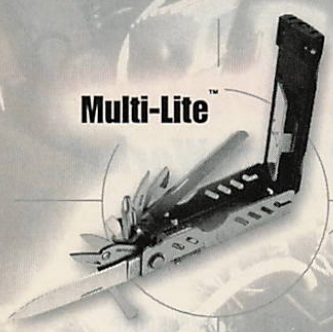

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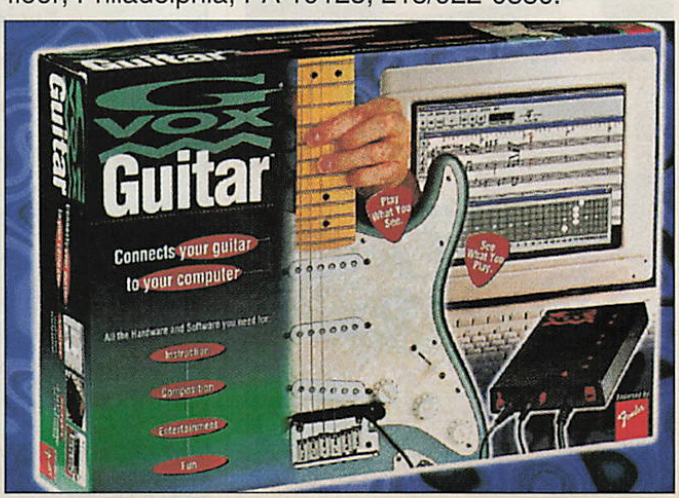
Great Stuff

Finish-Free Furniture

You want wood outdoor furniture, but you don't want to finish it, right? After all, you're supposed to be relaxing. You might consider products by Tidewater Workshop, a boatbuilding company that also makes outdoor furniture of eastern white cedar, a naturally weather-resistant wood. Sure, you can treat the wood or paint it if you like, the company says, but it's not necessary. The 4-ft.-long Monet bench shown (about $160, includes shipping) requires basic assembly to install four lagbolts and eight screws, but all holes are predrilled. Tables, chairs and serving carts are available also. Contact Tidewater Workshop, Route 9, Oceanville, NJ 08231; 800-666-8433.

Learn To Groove

If you've always wanted to play the guitar, this product's for you. No, you don't have to spring for private lessons or try to mimic Eric Clapton on MTV. Just plug a guitar into G-VOX Guitar, a new hardware/software package, which in turn connects to the serial port of any PC to instantly digitize music. It's available at computer superstores, consumer electronics retailers and mass merchandise chains for $99. For an extra kick, pick up G-VOX's Guitar 101: The Fender Method for $39.99 on CD-ROM and get the equivalent of four to six months of guitar lessons in one little disk. Contact G-VOX, 1080 N. Delaware Ave., 8th floor, Philadelphia, PA 19125; 215/922-0880.



Sticky Situation

Versachem's methyl methacrylate-based Plastic Welding System is a breakthrough in plastic fusion, providing a superhigh-strength 3500-psi bond. With a 15-minute set time, the 2-part adhesive bonds a variety of materials besides plastic, including metal, fiberglass, wood and china. The dispenser with snap-off caps comes with a handy mixing paddle. The adhesive sells for $3.99 at auto parts stores. Contact Versachem Corp., 6643 42 Terrace N., W. Palm Beach, FL 33407; 800-327-6880.

Good Friends

Project Buddy is a rolling work platform with rugged aluminum construction and lockable wheels for a firm stance. It's available in two sizes: a 4-ft.-long model with a height adjustable up to 4 ft. and a 5-ft.-long model that adjusts as high as 21 in. Both have a load capacity of 500 pounds, so they should be strong enough to hold two typical adults, some paint, tools and a bologna sandwich. Both models fold up to make them easy to carry or store, and two handles are provided on the uprights. The Project Buddy is sold at hardware stores, home centers and industrial supply houses. It costs $250 to $300. Contact Werner Climbing Products, 93 Werner Rd., Greenville, PA 16125. PM

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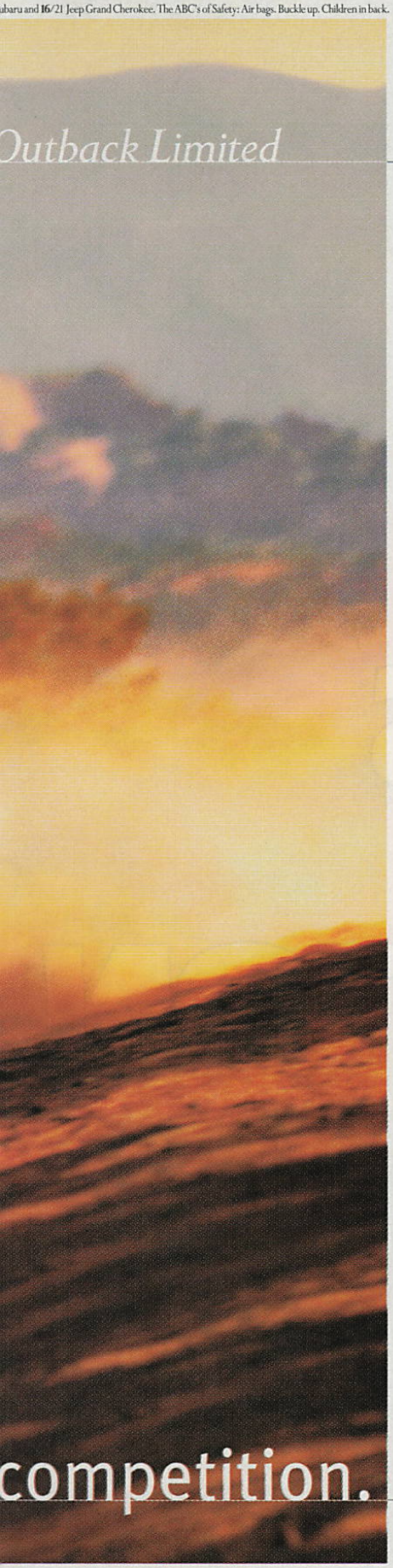
APC has won more awards for reliability than all other UPS vendors combined.

1997 Chevy Blazer turning stability claim based on USAC-certified dry lateral acceleration test. 1997 Ford Explorer braking comparison based on USAC-certified dry testing of 60-0 braking. Grand Cherokee fuel economy comparison based on 1997 EPA estimates of city/highway **21**/27

ubaru and 16/21 Jeep Grand Cherokee. The ABC's of Safety: Air bags. Buckle up. Children in back.



First, it whipped the Blazer in a test of turning stability. Then it topped the Explorer in a test of braking. Soon thereafter, it beat the Cherokee with its superior fuel economy. Now, the Subaru Outback® outshines these competitors in yet another arena: luxury. Our new Outback Limited offers all the creature comforts of your finer sport-utilities, like soft leather seating, woodgrain patterned trim and alloy wheels. It also offers something these competitors don't: the added luxury of two sunroofs. To test-drive this outstanding All-Wheel Drive vehicle, stop by your nearest Subaru dealer, call 1-800-WANT-AWD or visit our website at www.subaru.com

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WEAPONS OF MASS DESTRUCTION

Easy to build, easy to hide, they pose a greater threat to the American way of life than all of Russia's nuclear bombs.

BY CLIFF GROMER AND JIM WILSON; Photo by Barry Blackman

It happened across town

from the POPULAR MECHANICS office. Fanatics exploded a truck bomb in the garage of the World Trade Center. Although the blast killed six and injured more than 1000, we got off lucky. "A lone madman or nest of fanatics with a bottle of chemicals, a batch of plague-inducing bacteria or a crude nuclear bomb can threaten or kill tens of thousands of people in a single act of malevolence," says Defense Secretary William S. Cohen.

COVER STORY

Just how vulnerable is the United States to terrorists using weapons of mass destruction (WMDs)? R. James Woolsey, former head of the Central Intelligence Agency, tells PM he believes terrorists armed with WMDs represent the single most serious threat to U.S. national security. And one that at present we are ill-prepared to meet.

WMDs fall into three categories: chemical, nuclear and biological. Most experts agree that despite their occasional high visibility—for instance, after the Aum Shinrikyo nerve gas attack on a subway in Tokyo—chemical weapons pose relatively little threat. "Chemicals are big and bulky," says Woolsey. Even if a terrorist group can acquire mustard, chlorine or nerve gas in sufficient quantity, there remains the problem of dispersing the agents in a way that causes serious damage. "Some analysts believe that those who attacked the World Trade Center in 1993 laced their bomb with cyanide, which burned up in the explosion," says Richard K. Betts, director of the Columbia University Institute for War and Peace Studies, in New York.

PHOTOS: AP/WIDE WORLD PHOTOS/RON FREHM (LEFT); AP/WORLD WIDE PHOTOS/GINO DOMENICO (CENTER)

Police emergency teams, like the New York City unit shown above, are the first on the scene after terrorist attacks. As the result of increased threats from the Middle East, the National Guard will create 10 rapid assessment and initial detection (RAID) teams that state governors can call on to assist local authorities.

Radiological weapons don't explode. They kill with radiation alone—and they give anti-terrorism experts nightmares.

Quiet Nukes

The threat posed by nuclear weapons is both lesser and greater than that posed by chemical agents. This is because defense experts distinguish between two types: fissile, or explosive, weapons and radiological weapons (RWs). Soon after the collapse of the Soviet Union, it seemed almost certain that a stolen nuclear bomb would turn up on the black market. A slew of novels and action movies sketched out scenarios of attacks against cities and major public events, such as the Super Bowl.

None of these attacks has come to pass. Experts doubt one ever will. "Few terrorist groups have shown an interest in inflicting true mass destruction," says Betts. The reason: Fear of a nuclear reprisal against their home countries. And even if a group were so suicidally inclined, there remain the pesky details of designing and building a nuclear weapon. "Nuclear is tough to do unless you already have fissionable material," Woolsey points out. "A homemade nuclear device would be primitive, and also large and bulky."

As for an attack by a rogue state that somehow managed to buy stolen nuclear weapons, this also appears unlikely. Besides the dread of a counterattack, the problem is the delivery system. "Iraq, Iran or North Korea will not be able to deploy intercontinental missiles for years," explains Betts.

A more immediate concern is the nuke's quiet but deadly cousin, the radiological weapon. It isn't designed to explode, which solves 99.9% of the design problems. There is no blast or heat damage. Instead, RWs kill using radiation exposure alone. They were conceived here in the United States in the spring of 1943. At that time no one knew if the atomic bomb would actually detonate. But it was known that exposure to certain radioactive materials could kill. According to declassified Department of Energy records, J. Robert Oppenheimer, the scientific director of the Manhattan Project, and physicist Enrico Fermi considered using production reactors to make radioactive strontium in order to poison the German food supply.

Leaders of rogue states have shown their ability to acquire raw material (above) and warheads (top) to wage biological warfare.

RWs emit radiation—principally as gamma rays—that destroy individual cells. Bone marrow cells are especially vulnerable. Their death sets off a cascade of effects, including hemorrhaging and the collapse of the immune system. Unlike chemical weapons, which degrade once they come in contact with oxygen and moisture in the air, RWs can continue to inflict damage for years. An RW need only be "planted" in a public place to inflict its harm on everyone who passes by. This appears to have been what Chechen separatists had in mind in 1995 when they planted a vial of radioactive cesium in Izmailovsky Park, a popular Moscow flea market, just before Christmas. Police were tipped off and found the canister before anyone was hurt, according to the official account. United Nations chief weapons inspector Rolf Ekeus claims Iraq was working on RWs prior to the Gulf War.

Some idea of how deadly an attack with an RW might be comes from an accident that happened in 1987 in Goiania, a major city in south-central Brazil. A scavenger opened a lead canister attached to piece of abandoned medical equipment that had been hauled from a long-closed cancer clinic. It held cesium-137. Fascinated by the powder's luminous blue glow, he shared his find with his friends—who delighted in rubbing it on their bodies.

Coming soon to your medicine chest, a decontamination kit for chemical attacks?

Within a week the first victims began coming to the

PHOTOS: AP/WIDE WORLD PHOTOS/MOD (TOP); AP/WIDE WORLD PHOTOS (HUSSEIN); AP/WIDE WORLD PHOTOS/BURHAN OZBILICI (GADHAFI); AP/WIDE WORLD PHOTOS/UNSCOM (CENTER); BARRY BLACKMAN (BOTTOM)

Exhaled air fills protective suits, making it increasingly difficult to perform routine tasks.

local health clinic, exhibiting unmistakable signs of radiation sickness. Experts from the Brazilian government and later the International Atomic Energy Commission descended upon the city. More than 34,000 people were checked for signs of contamination. About 244 residents received a strong enough dose of radiation to become sick. Fifty required hospitalization. Approval to use an experimental anti-radiation drug saved all but four.

What might have happened had the cesium been dispersed intentionally, say from a small plane flying over the city, gives anti-terrorism experts nightmares. One of the few publicly available analyses of the threat posed by RWs was made by the Stockholm International Peace Research Institute (SIPRI). It concluded that RWs could be released effectively by delivery systems ranging from ballistic and cruise missiles to bombs, to a solid or liquefied mist sprayed from a remotely controlled aircraft. And, unlike chemical agents, RWs maintain their lethal effect even if they are dispersed with an explosive.

Biologicals

As frightening as RWs are, there is one final class of WMDs that poses even more concern, biological weapons. "Biologicals can be handled quite easily, and are effective in relatively small amounts," says Woolsey. "Producing a small quantity of bioweapons is about as difficult as running a microbrewery attached to a restaurant. The process is straightforward. You obtain the microorganism, and cultivate it in a growth medium. Drying the germs for use in a delivery system, such as an aerosol to spray anthrax, is the most difficult part of the process, but even this involves nowhere near the difficulties in cooking up nuclear or chemical weapons."

Once they're prepared, delivering the germs is relatively easy. The microbe mix could be sprayed from many different types of vehicles—everything from a light plane to a truck—or from canisters similar to insecticide bombs. You wouldn't even know that a weapon had been set off until a day or two later. And by that time it could be too late.

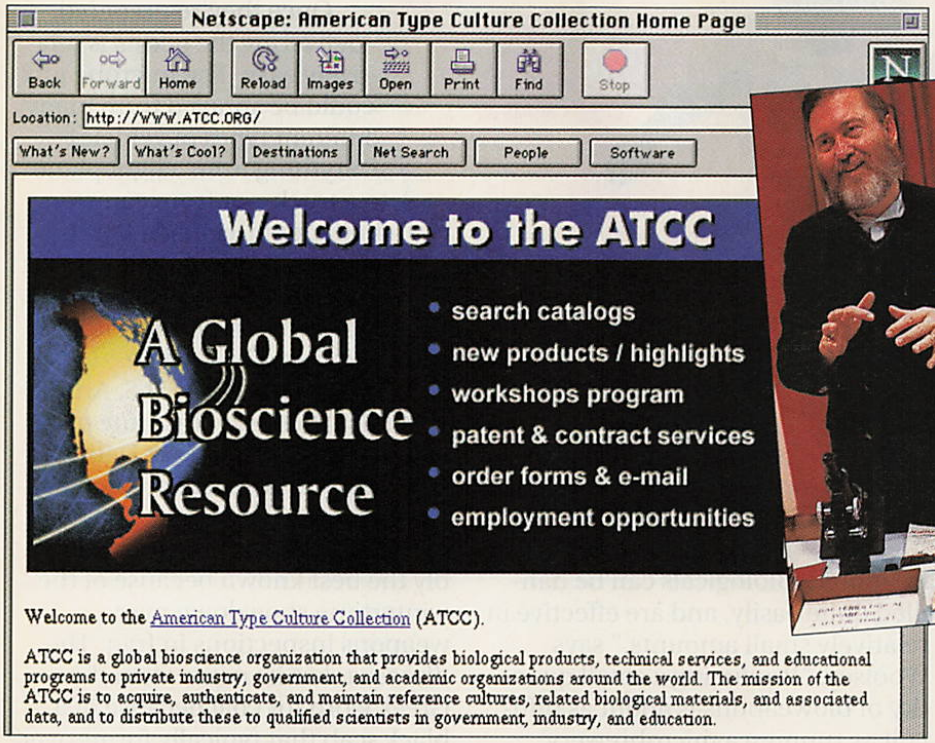
The experts at the U.S. Army Medical Research Institute of Infectious Diseases, in Fort Detrick, Md., tell PM that there are more than a dozen "bad actors" on the biowarfare stage. Anthrax is probably the best known because of the wintertime showdown over weapons inspections in Iraq. The disease takes its name from the Greek word for coal because of a black scab that typically forms over sores that develop on the hands and forearms of those who come in contact with anthrax-infected livestock.

Defense planners are more concerned with the inhaled form of the disease, called woolsorters' disease. This is a lung infection caused by breathing in anthrax spores. There is also a rare intestinal form contracted by eating insufficiently cooked meat from infected animals. In humans, the mortality rate ranges from up to 25% for the skin-contact form that

The nerve gas attack in Japan proved that small, dedicated groups could acquire impressively deadly arsenals.

PHOTOS: AP/WIDE WORLD PHOTOS/GINO DOMENICO (TOP); AP/WIDE WORLD PHOTOS/ATUSUSHI TSUKADA (CENTER); AP/WIDE WORLD PHOTOS/CHIAKI TSUKUMO (BOTTOM)

It takes several days before an anthrax victim experiences the first symptom. Then, death comes within 36 hours.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What's Cool?
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Net Search
People
Software
Welcome to the ATCC
A Global Bioscience Resource
search catalogs
new products / highlights
workshops program
patent & contract services
order forms & e-mail
employment opportunities
Welcome to the American Type Culture Collection (ATCC).
ATCC is a global bioscience organization that provides biological products, technical services, and educational programs to private industry, government, and academic organizations around the world. The mission of the ATCC is to acquire, authenticate, and maintain reference cultures, related biological materials, and associated data, and to distribute these to qualified scientists in government, industry, and education.

infects livestock workers to 100% for inhaled and intestinal cases.

Anthrax is in some ways the ideal biological weapon. The bacterium is easy to cultivate and forms spores that are highly resistant to sunlight, heat and disinfectants. Theoretically, these spores could be delivered as an aerosol cloud or with an atomizing spray device from, say, an aircraft like those used for crop-dusting.

The Internet provides ready access to WMD supplies and experts. Manufacturing equipment is no more complex than that sold for home canning.

It would take some time for people to realize they were in danger. Typically, it takes several days of incubation before a victim experiences the first symptom of anthrax, a flu-like malaise and fatigue. A cough and mild chest discomfort follow. Then come severe respiratory distress, shock and death within 36 hours of the onset of symptoms.

High doses of antibiotics can fight the disease, but by the time the symptoms are properly diagnosed, the victim normally is too far gone for help. Other biological agents with *potential* for adaptation as WMDs include: Argentine and Bolivian fevers, botulism, cholera, Congo-Crimean virus, Ebola, hantavirus, Lassa and Marburg fevers, plague, Rift Valley virus, staphylococcal enterotoxin B, Q-fever, smallpox, T-2 mycotoxins, tularemia and Venezuelan equine encephalitis.

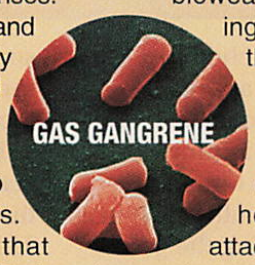
Each of these agents kills in a slightly different way. The common denominator among them is their size, less than 5 microns across. These diminutive proportions mean they can remain airborne over a target for hours or—in still, dry weather—a day or more. Once inhaled, their small size enables them to bypass the filtering mechanisms in the upper respiratory system and enter the lungs. From here it is a quick trip to the bloodstream, and for

How They Kill

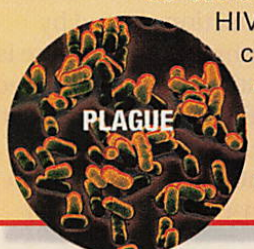
Biological Weapons

Biological weapons kill by spreading a disease that is normally fatal or by tricking the body's cells into producing a toxin that overwhelms its defenses.

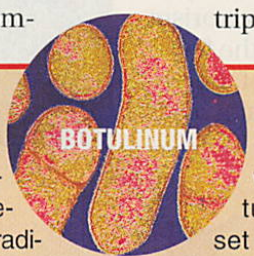
Although hundreds of bacteria and viruses are natural born killers, only a small number make good weapons. The viral hemorrhagic fevers novelists love to villainize are too rare and hard to grow to be useful to terrorists.



HIV, the virus that causes AIDS, is common enough, but cannot survive outside of a narrow temperature range. Smallpox, on the other hand, is so rugged and so contagious it remains a potential threat despite a successful global eradication program that has left only two acknowledged samples, one in the United States and the other in Russia.



Given the natural limitations on bioweapons, it is not surprising that the most serious threat is posed by some of mankind's most ancient plagues. These include anthrax, a disease common in cattle, horses and sheep that attacks the human respiratory system, causing death in a manner similar to pneumonia. Plague, the scourge of the Middle Ages, causes intestinal bleeding and ultimately kills by causing the respiratory and circulatory systems to collapse. Botulinum toxin works somewhat like nature's own nerve gas. They set up roadblocks that prevent the transmission of signals along nerves. Death typically follows collapse of the respiratory system. Gas gangrene naturally develops when soil contaminated with Clostridium bacteria finds its way into a wound. It also can be grown in an industrial setting. Initially, exposure causes a fever and sweating, followed by rapid pulse and a sudden drop in blood pressure. Victims then experience kidney failure, lapse into a coma and die.



PHOTOS: AP/WIDE WORLD PHOTOS/COLUMBUS DISPATCH, TIME REVELL (HARRIS); PHOTO RESEARCHERS/A.B. DOWSETT/SCIENCE PHOTO LIBRARY (ANTHRAX, BOTULISM); PHOTO RESEARCHERS/OLIVER MECKES (GAS GANGRENE, PLAGUE); PHOTO RESEARCHERS/LONDON SCHOOL OF HYGIENE & TROPICAL MEDICINE/SCIENCE PHOTO LIBRARY (SMALLPOX)

the unfortunate victim who does not find medical help, the cemetery.

Self-Defense

As dangerous as these killers are, there are ways we can defend ourselves. Woolsey believes the first order of business is simply to put someone in charge of dealing with WMD-wielding terrorists. This person would have the authority to put together a budget and make policy to cover such things as improving the capability of the CIA to spy on terrorist groups overseas, and the FBI to penetrate them at home. "Early warning," Woolsey maintains, "is essential for defense against biowarfare, and you don't get this kind of warning information from reconnaissance satellites."

The only difference between an innocent insect duster and a WMD is the chemicals loaded into the storage tank before takeoff.

Columbia's Betts cautions that protection may carry a higher price than Americans are used to paying. "Some of the most effective measures to prevent attacks within the United States may also challenge traditional civil liberties," he cautions. But even if the FBI tapped every telephone, monitored every book checked out of a library and read every piece of postal and electronic mail and Web page, there is no guarantee that it would stop a determined attacker. The Unabomber suspect who led the FBI on a multimillion-dollar chase for nearly two decades was finally caught only because his brother turned him in.

The second leg of Woolsey's strategy is to seek to minimize the damage caused by a biological attack by creating a closer partnership between government and the pharmaceutical and life sciences industries. Among other things, he would like to see the development of inexpensive sensors that can detect biological agents as soon as they become airborne. These would create a precious window of time for treatment—after exposure, but before symptoms appear. During this brief period, even most anthrax victims can be treated and saved. Thousands of lives could be saved, provided sufficient stockpiles of vaccines and antibiotics were dispersed in hospitals and clinics around the country.

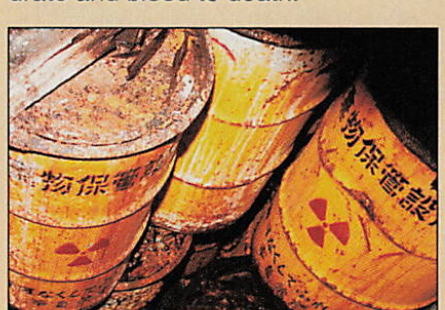
Woolsey admits that this kind of program will take effort. And it could cost billions. "People have to take the WMD threat seriously, but also realize that it is not a hopeless situation," he says. "There just are no silver bullets." PM

Chemical Weapons

Chemical weapons kill by destruction or disruption. The infamous "gases" of World War I—chlorine, phosgene and mustard gas—essentially burn away parts of the respiratory system. More modern nerve gases—Sarin, Soman, Tabun and VX—disrupt the chemical processes through which one nerve cell communicates with another. Death occurs when the heart and lungs stop receiving instructions to beat and breathe.

Nuclear Weapons

Stolen nuclear bombs make for great thrillers, but experts say radiological weapons pose a greater risk. These don't explode but disperse radioactive materials. Certain types of nuclear waste and "sources" used in medical equipment emit gamma rays. By killing fast-replicating blood-forming cells, and cells that line the intestinal tract, "radiation poisoning" causes untreated victims to dehydrate and bleed to death.



PHOTOS: BLACK STAR/JIM TUTEN (HELICOPTER); CORBIS-BETTMANN (WW I SOLDIERS); AP/WIDE WORLD PHOTOS/CHIAKI TSUKUMO (BARRELS); BARRY BLACKMAN (VIAL, PREVIOUS PAGE)

THE WORLD IS FLAT

Smaller, lighter and flat, LCD computer monitors prove that sometimes less is more.

BY SCOT FINNIE
Photos by Michel Tcherevkoff and Brian Kosoff

COMPUTERS

The potential of computer monitors is huge. No—come to think of it, it's actually small. New desktop PC liquid crystal displays (LCDs) are unobtrusive, exceedingly slim, and light and thin enough to be moved off the desk and mounted on the wall.

Flat-panel displays' benefits are many—and some might surprise you. From lower power consumption to a significant reduction of potentially harmful electromagnetic emissions, these new kids on the block are endearing and ready to show off their talents.

The main advantage of flat-panel displays over conventional monitors is space. In search of larger virtual desktops inside their PCs, computer users are forced to buy ever larger cathode-ray tube (CRT) monitors. First it was 12-in. displays, and then 14-in. Now 15 in. is the typical size and many people are choosing even bulkier 17-, 19-, and 21-in. monitors. At the upper end of the spectrum, these behemoths can weigh 80 pounds and displace a space roughly 21 in. square on your desk. But even a 15- or 17-in. CRT can make your real desktop feel like you're working on an airplane tray table in coach.

So is flat-panel technology ready for prime time? To find out, we subjected nine popular models to a battery of tests (see chart). In a nut-

LCD displays may be taking over your world in the upcoming future.

LCDs weigh about 70% less, use about one-third the electrical power and give off about one-third the heat of CRTs.

shell, we found we could replace our existing CRT monitors with any one of them and not lose image quality. In fact, some of them offered picture quality that surpasses a traditional CRT's.

Seeing Is Believing

They may not look much like the face of your wristwatch, but the technology behind flat-panel PC displays is a highly evolved variation on the liquid crystal displays first made popular in calculators and watches a couple of decades ago. Known as thin film transistor (TFT) active matrix, the type of LCD screen in flat-panel displays is exactly the same as that used for notebook PCs. Active matrix TFT displays have been around for a number of years, but two things initially held them back: size, and the cost and complexity of manufacturing. But all that has changed. Manufacturers have ramped up production, and they're working on larger and larger displays. For those of you with size fetishes, NEC even has a 20.1-in. active matrix LCD display (not tested).

CRTs are marketed according to diagonal tube measurements. These are usually larger than the actual size of the picture, known as the viewing area or image size. Most 15-in. CRTs offer image sizes ranging from just over 13 in. to just under 14 in. The image sizes of most 17-in. CRTs range from just over 15 in. to just under 16 in. Welcome to reality. But because flat-panel display image sizes are much closer to their advertised screen sizes, a 13.8-in. to 14.1-in. flat-panel display is effectively equal to a 15-in. CRT. The sole 15-in. panel display we tested for this story, the Compaq TFT500, compares to a 17-in. CRT monitor.

The single largest difference between an LCD display and a conventional monitor is the LCD's lack of a cathode-ray tube, also called a picture tube. This giant piece of glass and electronics causes CRT monitors and televisions to measure almost equally in all three dimensions. So a 15-in. CRT is roughly 15 in. deep on your desktop. A comparable flat-panel display is only about 6 in. deep, and most of that is for the base. If you were to mount it on the wall (a feat which surprisingly few are capable of), the average 14-in. LCD display would protrude only 3 in. or less.

By jettisoning the picture tube, LCD displays manage to weigh about 70% less, use about one-third the electrical power and give off about one-third the heat, compared to CRTs. Best of all, they show relatively flicker-free images.

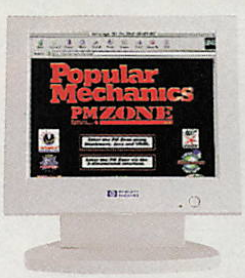
The reason LCDs are really flicker-free is that they are backlit with fluorescent lighting. By contrast, the light you see on a CRT screen is emitted by a phosphor excited by a stream of electrons passing over it. It's important to remember that there is no specific light source in a CRT. The electrons issue from electron guns at the base of the picture tube and literally scan thousands of phosphor dots, called picture elements, or pixels, which are arranged in lines running across the CRT screen. The electron scan passes across each line in turn, temporarily lighting up the phosphor at each pixel. As soon as the electron scan moves away from a given pixel, the light on that pixel begins to decay. When the electron scan has blanketed the screen, the next scan begins. All this happens in a split second, but while waiting for the electron scan to return, you get a quick flicker. The faster the speed at which the electron guns scan the screen—called the refresh rate—the less flicker the human eye sees. On an LCD screen, the light is constant. It emanates from a flat fluorescent tube that resides along the back of the screen, and the upshot is a good deal less flicker than you get with a CRT.

Discerning Eye

In 14- to 15-in. LCD screen sizes, models like the Eizo FlexScan L23

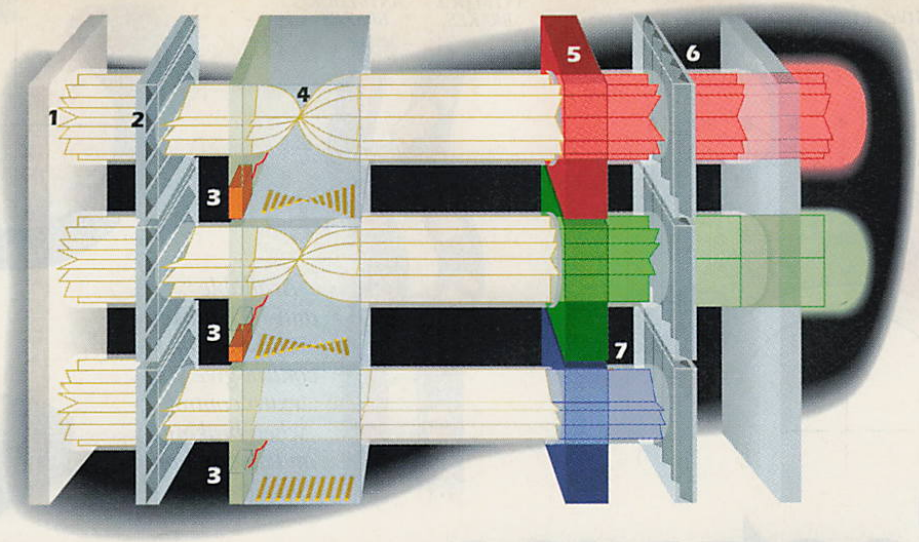
SPECIFICATIONS AND TEST RESULTS

The following data are the measured performing characteristics of each LCD from the Advanced Product Evaluation Labs in Bethel, Conn. *CD/m2=Candela/m², a common measuring unit for luminance.



MANUFACTURER MODEL	COMPAQ TFT500	EIZO FLEXSCAN L23	HEWLETT-PACKARD D5056A	MITSUBISHI LCD40
Est. Selling Price	$2450	$2250	$1900	$1875
Screen Size	15.1 in.	13.8 in.	14 in.	14 in.
Actual Image Size	14.56 in.	13.38 in.	14.05 in.	13.85 in.
Unit Weight	16 pounds 4 ounces	12 pounds 1 ounce	9 pounds 10 ounces	11 pounds 8 ounces
Height × Depth × Width	17.24 × 9.12 × 15.12 in.	14.72 × 6.5 in. × 14.12 in.	14.36 × 5.72 × 14.12 in.	13.84 × 6.36 × 14.6 in.
Viewing Angle: Horiz., Vert.	120°, 110°	120°, 105°	120°, 85°	120°, 90°
Brightness	82.3 (CD/m2*)	102.9 (CD/m2)	55.2 (CD/m2)	91.6 (CD/m2)
Contrast (percentage)	100%	100%	94%	100%
Color Temp. (Kelvin)	7900	9580	6930	8250

Inside A Flat Screen



1. LIGHT COMES FROM A FLUORESCENT PANEL.
2. A POLARIZING FILTER CREATES DIFFERENT HUES FOR DISPLAY.
3. PC'S GRAPHICS ADAPTER APPLIES ELECTRICAL CHARGES TO SOME CELLS, WHICH CAUSE THE LIQUID CRYSTAL MATERIAL TO FORM A SPIRAL.
4. POLARIZED LIGHT TWISTS ALONG SPIRAL PATH OF MOLECULES THAT WERE CHARGED.
5. LIGHT FROM LIQUID CRYSTAL CELLS PASSES THROUGH RED, BLUE OR GREEN COLOR FILTERS.
6. COLORED LIGHT THEN PASSES THROUGH SECOND POLARIZING FILTER.
7. IF LIGHT WASN'T TWISTED WHEN IT PASSED THROUGH LIQUID CRYSTAL, IT'S BLOCKED COMPLETELY.

and the Panasonic LCD40 showed up handsomely in our test, offering smooth, flicker-free images.

The Hewlett-Packard D5056A, Philips Electronics Brilliance 4500AX and Princeton Graphics LD50 were unable to display the 16 discernible shades of gray in our contrast test.

When we measured the brightness of the screens, the Hewlett-Packard came up with the lowest numbers.

The Philips Brilliance 4500AX was the brightest monitor. However, all of these monitors seemed bright enough to us. The color temperature test measures something that's wholly subjective. Higher color temperatures give an overall cooler color mix showing a preference for blue; lower numbers will make the colors look warmer, more yellow and orange. There's no right answer, but the Panasonic gets the nod for offering a user-selectable range of color temperature settings.

LCD panels have some unique sore points. One of these is something called drop outs, or bad pixels. It's virtually impossible to manufacture a perfect TFT active matrix display because of the overabundance of pixels that go into it. The most common shortcoming is a small point of white light where there should be blackness or a color.

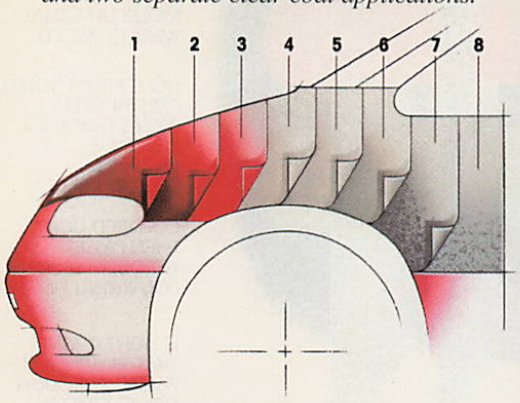
Another Achilles' heel is viewing angle. Earlier generations of LCD displays were unforgiving if you changed your perspective to the screen—either side-to-side or up-and-down. As your eyes moved away from dead center, both brightness and contrast diminished greatly, sometimes causing eyestrain. The latest crop of flat-panel displays has all but eliminated this problem by improving viewing angle, especially side-to-side. They're all easily adjustable in horizontal and vertical directions on their bases.

The last shortcoming is cost—because no matter what, flat-panel monitors are still expensive. But prices have come down dramatically, and experts predict more dramatic price cuts to come. A flat-panel display may be just the ticket to help you hide your home PC when you're not using it. Here's a tip: That old CRT would make an excellent planter. **PM**

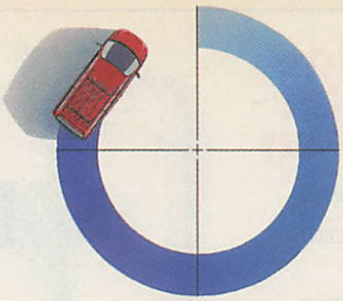
	PANASONIC LCD40	**PHILIPS BRILLIANCE 4500AX**	**PRINCETON GRAPHICS LD50**	**SAMSUNG 400TFT**	**VIEWSONIC VPA138**
	$2250	$1675	$2100	$1300	$1300
	14 in.	14.5 in.	13.8 in.	14 in.	13.8 in.
	13.66 in.	14.05 in.	13.38 in.	13.62 in.	13.66 in.
	12 pounds	11 pounds	9 pounds 6 ounces	8 pounds 10 ounces	12 pounds, 2 ounces
	14 × 5.84 × 14 in.	14.48 × 5.6 × 14.12 in.	12.6 × 6.48 × 13.72 in.	15.72 × 12.72 × 14.24 in.	15.5 × 6.5 × 15.12 in.
	100°, 100°	120°, 84°	140°, 110°	120°, 100°	120°, 85°
	113.2 (CD/m2)	215.4 (CD/m2)	137.2 (CD/m2)	109.8 (CD/m2)	89.2 (CD/m2)
	100%	94%	94%	100%	100%
	6400, 6550, 6900, 7900, 7910, custom	5875	8350	8600	10,000

ILLUSTRATION (TOP) FROM "HOW COMPUTERS WORK" BY RON WHITE (ZIFF DAVIS PRESS, MACMILLAN COMPUTER PUBLISHING)

To keep Caravan looking good at any angle, we use a highly protective, eight-step finishing process that includes a full-body powdered anti-chip primer coat and two separate clear coat applications.



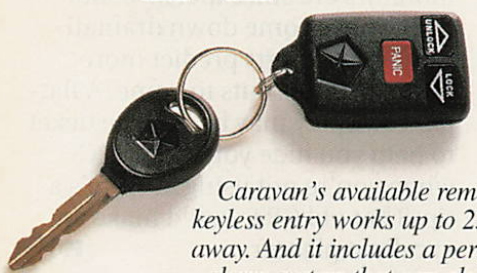
Available anti-lock brakes and traction control give you extra control when braking and steering on slick surfaces.



A remarkably tight turning circle makes parking easy.

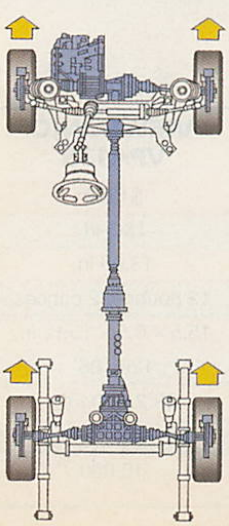
With 12 convenient storage bins, grabbing a tissue is not an issue.

Features you're sure to appreciate...



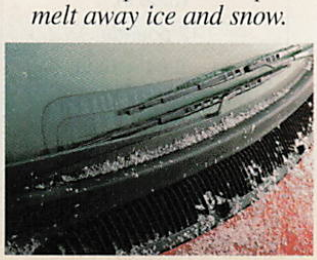
Caravan's available remote keyless entry works up to 23 feet away. And it includes a personal alarm system that can also be activated by remote control.

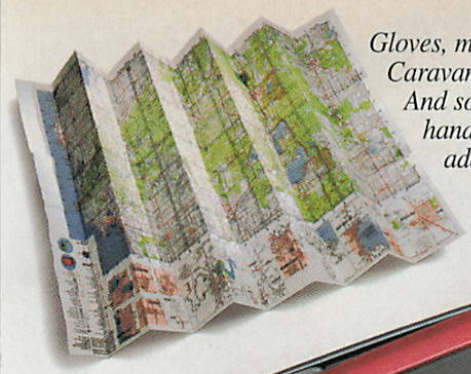
Caravan's available all-wheel-drive system features an inter-axle viscous coupling that automatically gives more torque to the rear wheels as needed.



When we redesigned Caravan we rounded the corners for a more aerodynamic shape, and still found a way to get 32 more cubic feet of room over the previous model.

The benefits are clear when you opt for heating elements under the front and rear wipers that help melt away ice and snow.





Gloves, maps and such can go in Caravan's tilt-out glove box. And some models have handy door pockets for additional storage.

To keep things nice and quiet, we offer carpeting that's backed by three layers of sound insulation.

Caravan not only offers a convenient driver's side sliding door, it's cleverly designed to hold both sliding doors open ... even when you're parked on the steepest of hills.

...if you're so inclined.

*Dodge Caravan is backed by our Customer One Care™ 3-year or 36,000-mile bumper-to-bumper warranty and 3/36 Roadside Assistance.**

For still more information, call 1-800-4-A-DODGE or visit our Web site at www.4adodge.com

**See limited warranty & restrictions at your dealer. Excludes normal maintenance & wear items.*

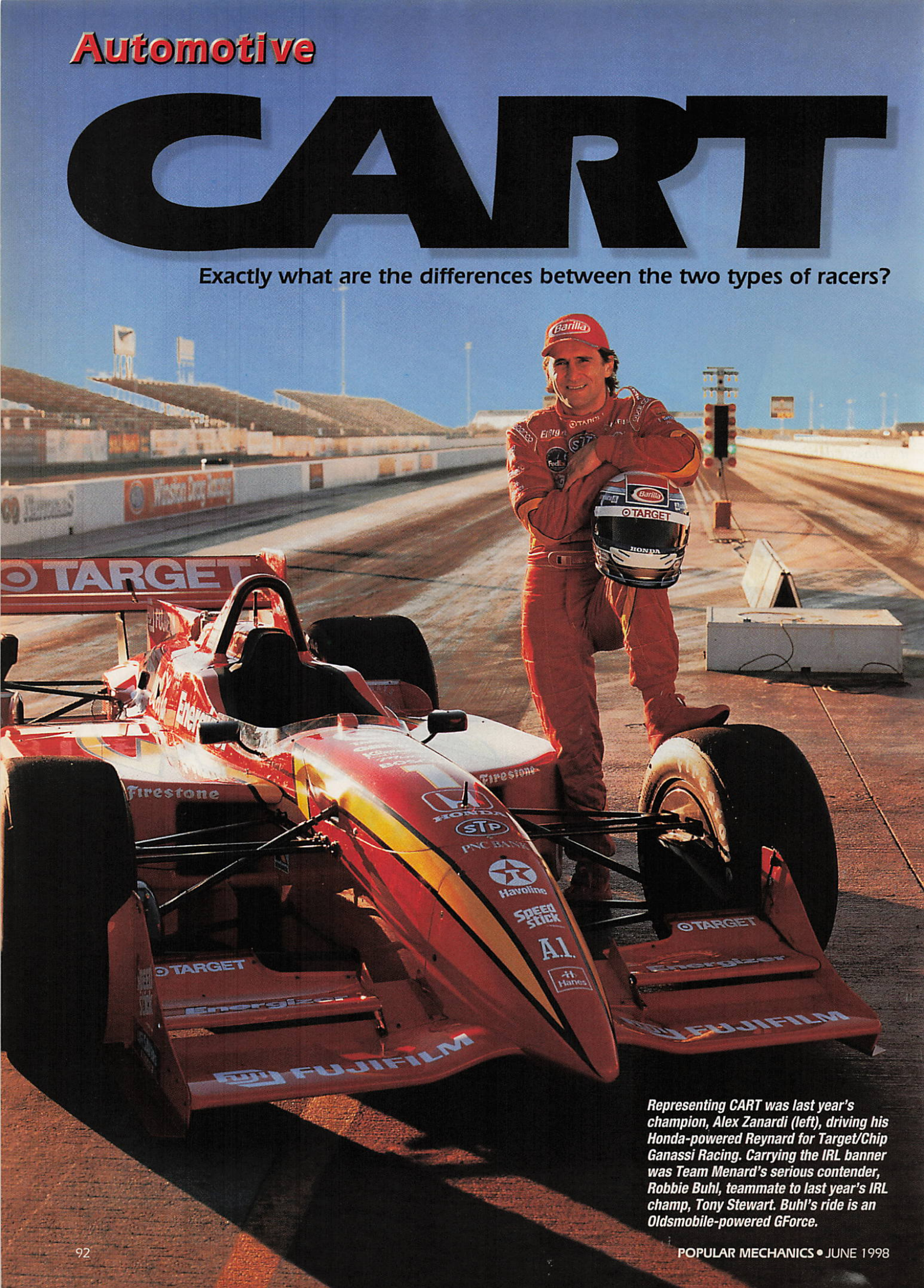
Always use seat belts. Remember a backseat is the safest place for children.

Caravan The New Dodge

Automotive

CART

Exactly what are the differences between the two types of racers?



Representing CART was last year's champion, Alex Zanardi (left), driving his Honda-powered Reynard for Target/Chip Ganassi Racing. Carrying the IRL banner was Team Menard's serious contender, Robbie Buhl, teammate to last year's IRL champ, Tony Stewart. Buhl's ride is an Oldsmobile-powered GForce.

vs. IRL

We test the champion cars to see.

BY SCOTT OLDHAM; Photos by Bill Delaney

Ray Harroun. May 30, 1911.

Unlike George Washington and his birth date, Ray Harroun and the date he won the first Indianapolis 500 are not taught in high-school history classes. Even the brains on "Jeopardy" haven't heard of Harroun.

MOTORSPORTS

Recently, one of that game show's categories was U.S. History. Alex Trebek stated the $400 answer: "On May 30, 1911, with a time of 6:42:08, Ray Harroun won the first running of this."

One egghead buzzed in and answered, "What is the New York Marathon," while the other two geniuses stood there like deer in headlights, buzzer fingers motionless.

Ray must have been spinning around in his grave.

By now, he is used to such agitation. The 1994 running of NASCAR's inaugural Brickyard 400 stock car race at Indy surely gave Harroun a little exercise, and the formation of the Indy Racing League in 1995 probably had ol' Ray twisting like Chubby Checker on "American Bandstand."

When Indianapolis Motor Speedway president and owner Tony George booted the guys from the Championship Auto Racing Teams (CART) out of Indy and formed the Indy Racing League (IRL), he envisioned an ovals-only series that would keep the cost of racing down and give up-and-coming American drivers

a place to race. Although not many people questioned the concept, many did question George's use of the Indy 500, "the greatest spectacle in racing," as the centerpiece for a series for mostly talented but still unproven drivers. Suddenly CART was without the Indianapolis 500 and Indy was without CART's big-name drivers, like Michael Andretti and Al Unser, Jr. A fierce rivalry quickly developed between the two organizations, and on Memorial Day 1996, the same day as the Indy 500, CART ran its own 500-mile event, the U.S. 500, at Michigan International Speedway. By 1997, the IRL had its own rule book, and its own engine and chassis formulas.

Now, in 1998, the IRL series is up to 10 events, including the Indianapolis 500, while CART will run 19 events. The rivalry is still strong, but the world is finding room for both series. The Indy 500 seems to be big enough to survive with a field of unknown drivers, and CART continues

Zanardi drove through our lane change quicker than anyone ever did. He locked the fronts (opposite) under braking, however.

Target/Chip Ganassi came in force for the test. Zanardi's method of heating the tires (left) helped keep manager Mike Hull and the team members busy.

to thrive without the big race.

Politics and marketing aside, what are the differences in the hardware between the two series? The rules are different. But on the surface, the cars that result don't look all that different from each other. Just how similar—or unlike—are they? And what are the differences in performance? We wanted to know too, so we set out to find out. But how?

Hey, this might be cool. Let's get a car from each series and test them. Let's run the race cars through our usual battery of car tests, just as we would a Ford Taurus and a Chevrolet Lumina, to see just how fast these things are. In the process we'll learn the mechanical differences that lurk under the similar skins. Great idea! Let's do it.

And so, a few days before the IRL race in Phoenix in March, we rented Firebird International Raceway and had at it. 1997 CART champion Alex Zanardi and the Target/Chip Ganassi team came out with their Honda-powered Reynard chassis. And representing the Indy Racing League, Robbie Buhl, teammate to 1997 IRL champion Tony Stewart, and Team Menard brought out their Oldsmobile-powered GForce chassis. Both tore through our tests like George "The Animal" Steel eats through a turnbuckle. Here's what happened.

Championship Auto Racing Teams

The car Ray Harroun drove to victory that long-ago Memorial Day, a Marmon Wasp, now sits in the Indianapolis Motor Speedway Hall of Fame Museum. It was the only single-seater at Indy that first year. The other competitors all used a riding mechanic to help with rear vision, while Harroun installed the world's first rearview mirror and drove the race solo.

Eighty-eight years later, descendants of Harroun's open-wheel, single-seat race car continue to rip, and 32-year-old Italian-born Alex Zanardi has mastered the art of driving them. In 1997, Zanardi won five CART races, and took home the PPG Cup championship.

For '98, Zanardi and teammate (and 1996 champion) Jimmy Vasser are driving Reynard chassis with Honda engines and Firestone tires. There are other packages available in the series. Engines are available from Ford, Mercedes-Benz and Toyota, chassis from Penske, Swift and Lola, and tires from Goodyear. But the

INDY RACING LEAGUE

SPECIFICATIONS AND DIMENSIONS

FORMULA RACING SERIES	APPROX. CHASSIS AND ENGINE COST	ENGINE TYPE/DISP. (liters/ci)	APPROX. ENGINE HORSEPOWER	GEARBOX TYPE/SHIFT PATTERN	APPROX. WHEELBASE/ LENGTH (in.)	APPROX. TRACK WIDTH (in.)	OVERALL WIDTH (in.)	BODY WIDTH/ HGT.†† (in.)	WEIGHT (lb.)/ WEIGHT/HP RATIO	TIRE SIZE (in.) (front/rear)	WHEEL SIZE (in.) (front/rear
CART	$2,130,000	dohc 32v V8†/ 2.65/161.7	more than 750 @ 14,000 rpm	4-speed/ sequential	123.0/ 190.0-196.0	74.0	78.5	63.0/ 32.0	1550 2.07	11.0-12.5x25.0-26.0/ 15.25-16.75x26.5-27.5	10.0x15.0†† 14.0x15.0†
IRL	$360,000	dohc 32v V8/ 4.0/244.1	675, rev-limited to 10,500 rpm	6-speed/ H-gates	110.0 min./ 192.0-196.0	74.0	78.5	63.0/ 32.0-36.0	1620 2.4	11.0-12.5x25.0-26.0/ 15.0-16.75x26.5-27.5	10.0x15.0/ 14.0x15.0

† twin-turbocharged. †† at rest, decreases with speed. ††† +/- ¾ inch. 1. Best time from 40 to 70 mph. 2. Best stop hot or cold. 3. Best speed weaving through eight cones 75 ft. apart. Index of transient response.

Honda/Reynard/Firestone combination is the same one that won Zanardi and Vasser back-to-back championships.

The car showed up at Firebird in road-course trim per CART rules, which specify everything from a car's dimensions to the amount of boost provided by the engine's turbochargers to the placement of the numbers on the carbon-fiber bodywork.

For road-course competition, the rules mandate a minimum weight of 1550 pounds, 40 in. of turbo boost (5.4 psi), an overall length between 190 and 196 in., an overall width of 78.5 in., and a maximum body width of 63 in. And the car can't be higher than 32 in. Road-course trim also dictates the use of larger front and rear wings than are allowed when the cars race on ovals and superspeedways.

With a power-to-weight ratio of 2.28:1, including driver Alex Zanardi on board, we expected some big numbers from this car. And we got them. This is the quickest, best-handling and best-stopping motor vehicle POPULAR MECHANICS has ever tested.

Larry Curry and the crew of Team Menard kept adjusting Buhl's car to help it turn right—something it doesn't normally do in the course of the IRL race season.

It's weird seeing a champ car on the dragstrip, sort of like seeing Michael Jordan in the batter's box. But that monster power-to-weight ratio literally rockets this car down the track. Zanardi had trouble heating up his tires, so wheelspin kept the car from recording ultimate times. A dozen smoky donuts, Zanardi's signature move, helped. Still, even with Zanardi short-shifting all six gears at 15,000 rpm and fighting for traction down the entire quarter mile, his best elapsed time was a blazing 9.30 sec-

TEST RESULTS

WHEEL WEIGHT (lb.) (front/rear)	SUSPENSION CONFIGURATION (front & rear)	MINIMUM ALLOWABLE BRAKE SIZE (in.)/ CONFIGURATION (f/r)	ACCELERATION 0-30 MPH (sec.)/ 0-60 MPH (sec.)	1/4-MILE ACCELERATION (sec./mph)	PASSING ACCELERATION[1] 40-70 MPH (sec.)	BRAKING 60-0 MPH[2] (ft.)	525-FT. SLALOM[3] (mph)	200-FT. SKIDPAD[4] (lateral g)	LANE CHANGE[5] (mph)
13.48 min./ 14.7 min.	unequal-length A-arms, pushrod-actuated coil/shocks, antiroll bars	11.0x0.5/ disc/disc	2.19 3.69	9.30/ 165.50	1.41	103.56	69.9	1.42	74.6
13.48 min./ 14.7 min.	unequal-length A-arms, pushrod-actuated coil/shocks, antiroll bars	12.8x1.0/ disc/disc	2.08 3.76	10.00/ 153.01	1.59	107.89	62.3	1.38	68.6

g-force around a 200-ft.-dia. circle. Average of best cw and ccw. 5. Best speed through a 250-ft.-long double lane change.

onds at 165.5 mph. Sideways.

Because of the traction problem, this car was actually slower off the line from 0 to 30 mph than the last Viper coupe and Porsche Turbo we tested. However, from 30 mph up, the race car accelerates like a bullet from a Glock. Sixty mph hit Alex in the face in just 3.69 seconds, still in First. The 40-to-70-mph passing time of 1.41 seconds is mind-blowing, considering the Viper takes 2.46 seconds to do it.

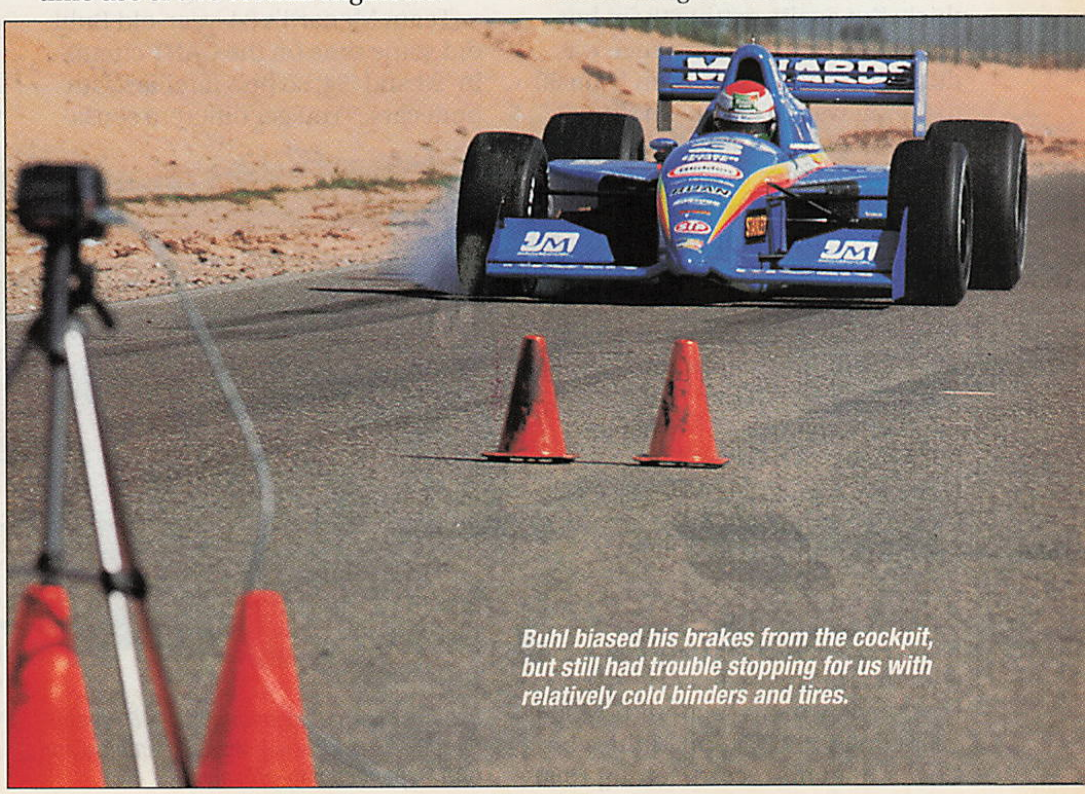
Providing the enormous power is a tiny 2.65-liter (161.7 cu. in.) double-overhead-cam 32-valve twin-turbocharged V8 engine that runs on methanol. Honda is very secretive about the specs of its '98 race engine, and they wouldn't allow us to photograph it in race trim in Zanardi's car. The engine's redline, compression ratio and dimensions are better-kept secrets than the contents of Area 51.

But Honda will say the engine makes more than 750 hp at 14,000 rpm. The block is aluminum alloy and it has five main bearing caps. The crankshaft is alloy steel and the pistons are made of forged aluminum alloy. They ride on machined alloy steel connecting rods. The engine uses a dry sump oiling system, a single water pump, electronically controlled fuel injection and an ignition and engine management system designed by Honda and Motorola.

The teams lease the engines from Honda for the season at a cost of $1.5 million, which includes the full-time use of two Honda engineers.

After the drag testing, we asked Zanardi if he liked it enough to go after John Force next season. His reply came without hesitation, "No, I want to make turns." With that, we headed over to the skidpad to make turns.

Heating the tires was a problem, again. But Zanardi muscled the understeering car around in Second



Buhl biased his brakes from the cockpit, but still had trouble stopping for us with relatively cold binders and tires.

The biggest difference is the bottom line. An IRL car: $360,000. CART: $2.13 million.

gear, and recorded an average of 1.42 g. The team's telemetry said the car reached 1.6 g during the run. Quite a bit more than the high of .90 g we recorded in the Dodge Viper.

On to the lane change. Here's where our testing really showed how superior this car is compared to even the most awesome street car. Zanardi tore through the lane change in First gear, with a bit of opposite lock through the last gate at a speed of 74.6 mph. That's 13 mph faster than a 911 Turbo.

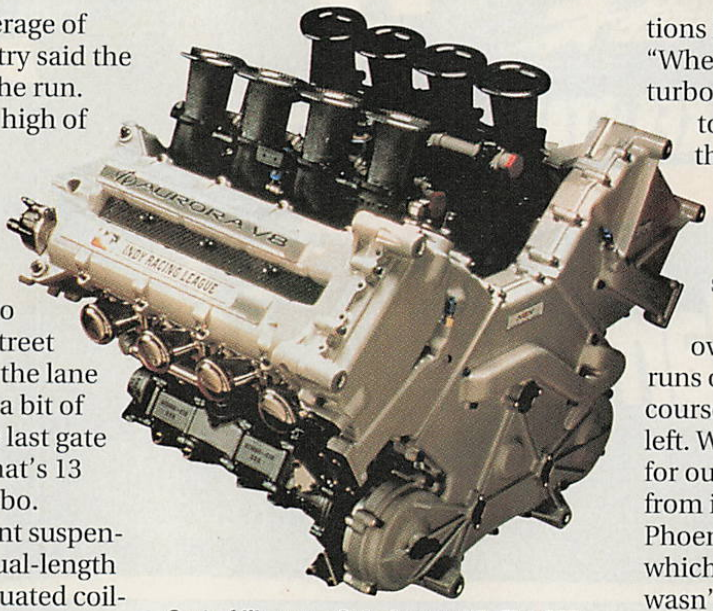
The 4-wheel independent suspension, which features unequal-length control arms, pushrod-actuated coil-shock units and cockpit-adjustable antiroll bars front and rear, didn't like the rough patches that littered the pavement of our test facility, or no doubt the speed would have been even higher. Through the slalom, where the Porsche 911 Turbo is king of the street cars with a speed of 50.3 mph, Zanardi's champ car sliced through the cones at 69.9 mph. Here he used Third gear, and at the fourth of eight gates, the car's telemetry recorded a peak of 1.63 g.

We expected equally impressive results from the car's brakes. It wears 4-wheel discs that measure 12.9 in. in diameter and are 1.1 in. thick. But again, getting them hot enough for max performance was difficult. Zanardi's best run from 60 to 0 mph was 103.56 ft. Not the mind-blower we thought it would be, but still more than 6 ft. shorter than a 911 Turbo, which is considered the best-stopping street car on Earth.

Through our testing, the Target/Chip Ganassi car averaged 2 mpg and used about 12 gal. of fuel. Besides all that methanol, it took an 18-wheeler full of gear, two sets of Firestone tires, and a crew of 10, including a data engineer, to get the car through the day.

Indy Racing League

Last year, in the first Indy 500 with the IRL spec cars, Arie Luyendyk won his second Indy 500, averaging 145.827 mph, quite a bit slower than his record-setting 1990 winning pace of 185.981 mph—and quite a bit faster than Ray Harroun's average of 74.59 mph.



Sort of like your Olds Aurora V8. The 675-hp IRL engines share some dimensions and design with the passenger-car version.

Luyendyk drove an Oldsmobile Aurora-powered GForce chassis to that win, the same combination Robbie Buhl hoped to drive to the milk in May. It's also the same combination Buhl's teammate, Tony Stewart, drove to the IRL championship last year. With performances like that, the rival Infiniti Indy engine, Dallara chassis and Goodyear tires have some catching up to do.

Team Menard's 34-year-old Buhl did some time on the CART circuit in '93 and '94, so he's familiar with both cars. "You get different sensations in both cars," he told us. "When I was driving CART, the turbocharged engines were revving to 13,000 rpm, and I know they're running even higher now. The IRL has mandated a 10,500-rpm rev limit on these normally aspirated V8s, so they're quite different."

Remember, the IRL is an oval-only series, while CART runs on ovals, road and street courses. IRL cars have to turn only left. When Team Menard showed up for our session at Firebird, fresh from its own testing up the road at Phoenix International Raceway, which is a 1.0-mile oval, the car wasn't handling very well, and the team knew why. "The car is set up to turn only left at 180 mph," said team manager Larry Curry. "It doesn't want to turn right at 70 mph."

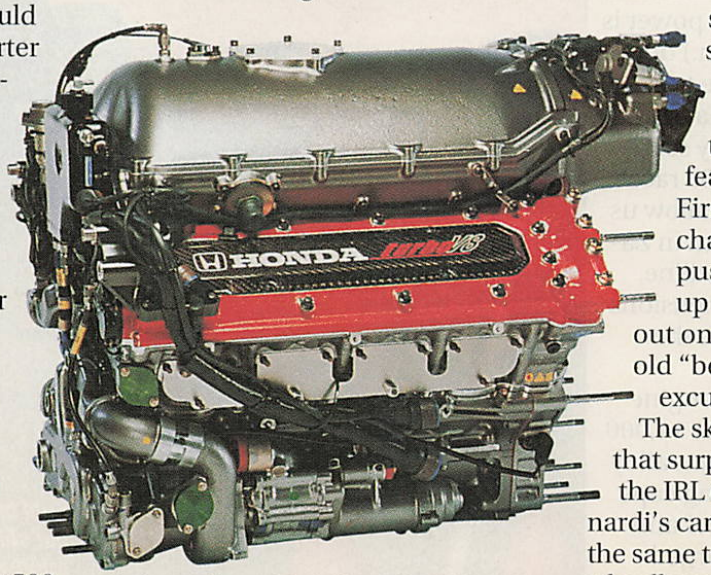
In fact, with no negative camber set in the right front suspension, Buhl was riding on the outer edge of the tire, instead of the inner edge, considered the sweet spot. The wrenches came out. The guys disconnected the front sway bar, connected the rear sway bar, added negative camber to the right front by removing some shims and went to "max flap," which means they dialed in as much front wing as possible, 40°, for added downforce. On IRL cars the rear wing is not adjustable.

The car immediately woke up. Around the skidpad, performance went from 1.15 lateral g, which is still way better than any street car, to 1.38 g—a mere tick under Zanardi's car. Buhl ran around the 200-ft.-dia. circle feathering the throttle in First gear. The suspension changes dialed out a lot of push, and loosened the car up enough for Buhl to spin out once, for which he gave the old "bee-flew-in-my-helmet" excuse. We didn't fall for it.

The skidpad performance isn't that surprising considering that the IRL car weighs more than Zanardi's car at 1620 pounds, has about the same track at 74 in., and a shorter wheelbase at a minimum of 110 in.

The GForce chassis also uses

(Please turn to page 154)



In barest form, this is Honda's CART motor for '98—less turbos, exhaust plumbing and CART-supplied pop-off valve.

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LIP SERVICE

Voice recognition software can make life easier for any computer user.

BY KIM KOMANDO; Photo by Michel Tcherevkoff

COMPUTERS

Speech recognition software has received a lot of fanfare lately, specifically IBM's ViaVoice and Dragon Systems' NaturallySpeaking programs. Read the press on either of these products and you're likely to see words like *only, first, best* and a host of other superlatives. Let's set the record straight on one thing: Speech recognition software is nothing new. It's been around for a long time—it just seems to pop up every few years when some new advancement is achieved.

This time around, a technology called "continuous speech" has picked up the giant spotlight. Older speech recognition products generally required you to speak in a robotic, one-word-at-a-time manner. Using a product with continuous speech technology means you can speak in a more normal—not necessarily entirely normal—tone as you dictate to your computer.

Both IBM and Dragon offer multiple versions of their programs. Naturally, the more you pay, the more features you get. Knowing that POPULAR MECHANICS readers want nothing but the best, we examined the top-of-the-line offerings from both: IBM's ViaVoice Gold and Dragon's NaturallySpeaking Deluxe.

You'll find basically the same thing in both: a CD, documentation and a headset microphone. Both note that some computers may require a separate battery box to attach to the headset. Whereas the NaturallySpeaking package includes said battery box, the ViaVoice package only includes instructions on how to acquire one. So much for out-of-the-box functionality.

As far as headsets go, I preferred the Dragon unit over the IBM unit. It had sturdier construction, the ear pad was larger and softer, and the cable that leads to your soundcard was longer by about 2 ft. However, both were adequate for the task at hand.

Do As I Say

Speech recognition has always required user-specific training. In other words, you need to speak to the software so that it can learn the subtle nuances of your voice, tone and inflection. The more you train the software, the more accurate it becomes.

IBM claims you can use ViaVoice right out of the box with no need for formal software training. But once you install and launch the program, ViaVoice makes a strong recommendation that you do engage in some software training and gives you the opportunity to do so at that point.

IBM claims that this training takes only about 8 minutes. That's true—as long as you don't plan to use your computer as soon as your 8-minute training session is over. For 8 minutes, you read boring sentences about the ViaVoice software, and speech recognition technology in general, as they're displayed on your screen. However, ViaVoice doesn't process your input until you're through.

The program warns—after you've already put in your 8 minutes—that this processing can take anywhere from 20 to 50 minutes. Luckily, on the Hewlett-Packard 233-MHz Pentium II system I used to test these products, the process only took about 10 minutes.

NaturallySpeaking is more forthcoming in terms of

software training. Whether you like it or not, the program guides you into a 30-minute session. Happily, this training is not quite as boring as the ViaVoice training. You're able to choose from several popular works from which to read. I chose a passage from *Dave Barry in Cyberspace*. Dragon Systems undoubtedly chose this passage for Barry's favorable statements about speech recognition technology.

Thirty minutes is a long time to talk into a little microphone. NaturallySpeaking advised me that I could take a break if I wanted, but it also stated that if I quit the program before the training was completed, I'd have to start over. I didn't want to take any chances, so I trudged on to the end, parched mouth and all. One peculiar note: During the training, I was required to say the word "oh." Despite repeated attempts with my clearest possible pronunciation, NaturallySpeaking couldn't recognize the word and I was forced to manually advance the training.

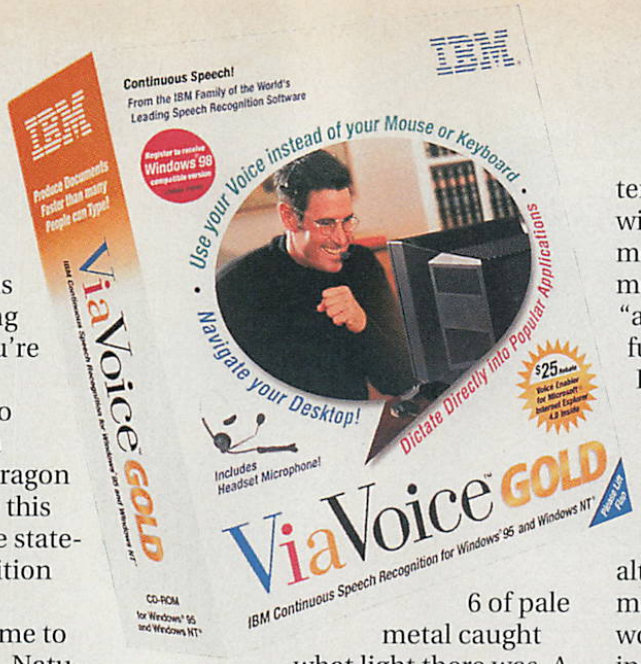
Like ViaVoice, NaturallySpeaking needs to process your training session after you've finished speaking. Although the NaturallySpeaking training was over three times longer than that of ViaVoice, the processing took a couple of minutes less.

Look, Mom, No Hands

Of course, headset comfort and length of training should not determine which product you purchase. The real proof is in the capabilities of the software.

Rather than rely on my own chatter, I decided to test drive these programs by reading from a book. I reached randomly for my bookshelf and when my hand came back, it was holding Dashiell Hammett's classic *The Maltese Falcon*.

Hammett used some interesting sentence structures and colorful word choices, so I figured this would be a good test of the software. I used the following paragraphs: "In front of the second house from the corner, Spade halted. On one of the gateposts that were massive out of all proportion to the fence flanking them a 2 and a


IBM
Continuous Speech!
From the IBM Family of the World's Leading Speech Recognition Software
Register to receive Windows 98 compatible version
Use your Voice instead of your Mouse or Keyboard
Navigate your Desktop!
Dictate Directly into Popular Applications
$25 Rebate
Voice Enabler for Microsoft Internet Explorer 4.0 Inside
Includes Headset Microphone!
ViaVoice GOLD
IBM Continuous Speech Recognition for Windows 95 and Windows NT
Produce Documents Faster than many People can Type!
ViaVoice GOLD
CD-ROM for Windows 95 and Windows NT

6 of pale metal caught what light there was. A square white card was nailed over them. Putting his face close to the card, Spade could see that it was a For Sale or Rent sign. There was no gate between the posts. Spade went up the cement walk to the house. He stood still on the walk at the foot of the porch-steps for a long moment. No sound came from the house. The house was dark except for another pale square card nailed to its door.

"Spade went up to the door and listened. He could hear nothing. He tried to look through the glass of the door. There was no curtain to keep his gaze out, but inner darkness. He tiptoed to a window and then to another. They, like the door, were uncurtained except by inner darkness. He tried both windows. They were locked. He tried the door. It was locked."

As I expected, neither program made it through these two paragraphs unscathed, although NaturallySpeaking did produce noticeably more accurate results on the first round. It came as no surprise that words like "tiptoed" and "uncurtained" gave both programs problems. This next nuance might be important if you use a lot of numbers in your writing: While ViaVoice produced the numerals "2" and "6," NaturallySpeaking spelled them out.

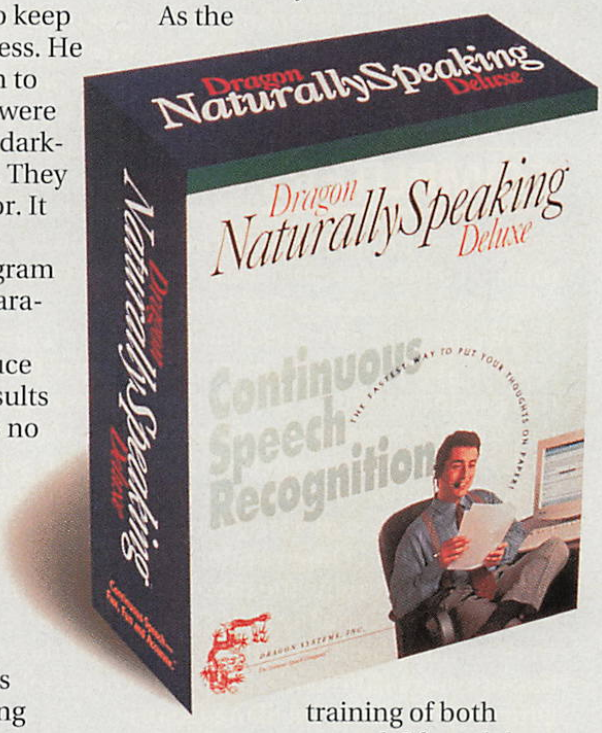
One point that I found especially humorous, maybe telling, is that on the first go-around, both programs capitalized the word "windows," as in Microsoft Windows. It seems that both IBM and Dragon have forgotten that there are other types of windows in the world. (The comment ViaVoice made about my mother when trying to interpret "and then to another" also was funny, but I'll spare dear Mom.)

During one of my test runs, both programs recorded "a 2 and a 6" as "a 286"—interesting in that most 286s that are still around are indeed of pale metal.

I also found it noteworthy that although both programs claim to match context for like-sounding words, ViaVoice used "accept" instead of "except" in the last sentence of the first paragraph. I corrected this and ViaVoice got it right the next time. Gold star!

As I mentioned earlier, these programs learn how you speak as you go. For your part, as teacher you need to go back and manually correct any mistakes produced by the program. Despite repeated attempts, ViaVoice could never quite get a handle on the phrase "that were massive out of all proportion." On the other hand, NaturallySpeaking aced this phrase by the second try.

As the


Dragon NaturallySpeaking Deluxe
Dragon NaturallySpeaking Deluxe
Continuous Speech Recognition
THE FASTEST WAY TO PUT YOUR THOUGHTS ON PAPER!

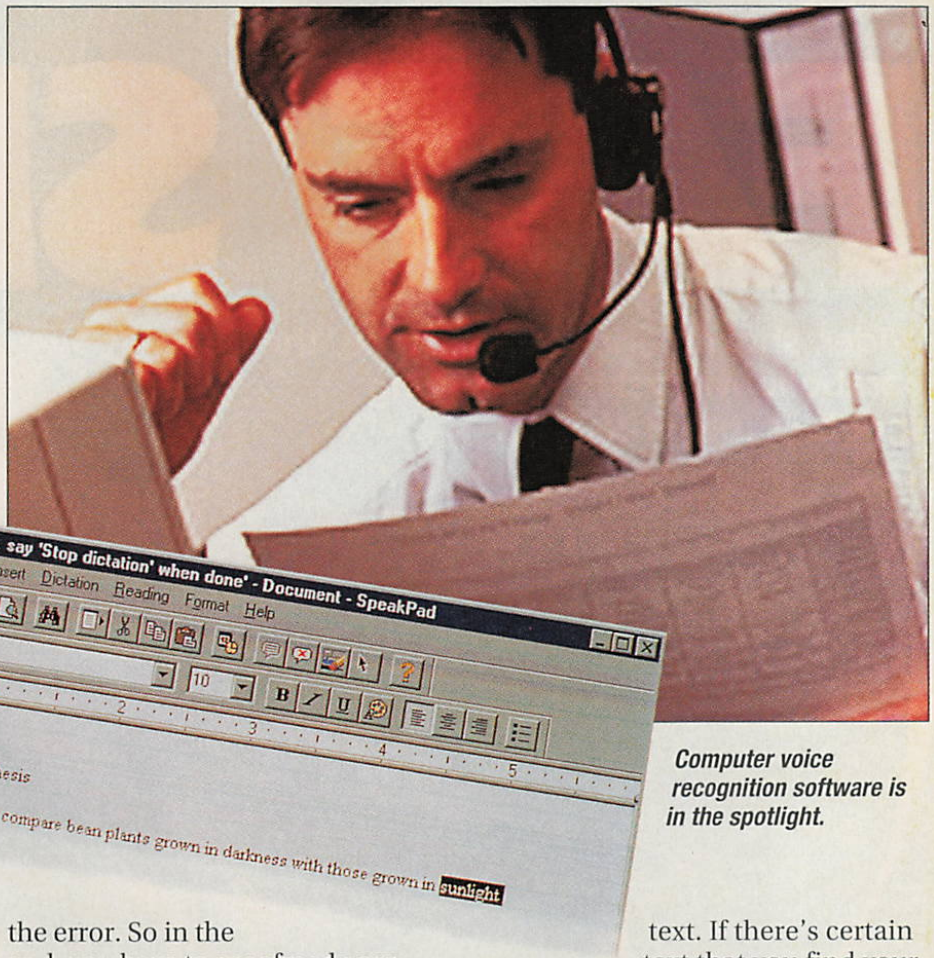
training of both programs progressed, I found that NaturallySpeaking continued to produce more precise results. But I never achieved 100% accuracy with either program.

Although NaturallySpeaking produced the more accurate results by

For the mainstream computer user, the technology just isn't quite there yet.

a hair, I liked the ViaVoice interface better. For one thing, ViaVoice was able to keep pace with my speaking fairly well. As I spoke, the words appeared in the document. On the other hand, in NaturallySpeaking the words appear as you say them in a little drop-down box below the text cursor, and then appear as actual text in your document several seconds later. As I read, NaturallySpeaking fell further and further behind, which I found somewhat annoying.

I also found corrections much easier in ViaVoice. If the program misinterprets a word, you triple-click on it and a little correction dialog box pops up. In NaturallySpeaking, you select the wrong word, right-click on it, and then select Correction Mode from the resulting pop-up menu—a couple of steps more than ViaVoice for the same results.


'Dictating... say 'Stop dictation' when done' - Document - SpeakPad
File Edit View Insert Dictation Reading Format Help
Times New Roman
10
Subject: Science
Concept: Photosynthesis
Demo: Have students compare bean plants grown in darkness with those grown in sunlight

Computer voice recognition software is in the spotlight.

It's Not Perfect

There are a couple of aspects of speech recognition that I generally don't care for. For starters, you have to speak all of your punctuation, paragraph returns, etc. What can I say? Saying "period" at the end of every sentence hardly qualifies as continuous, natural speech in my book. I look forward to a day when speech recognition software can figure this stuff out for you.

Also, there's a very important difference between mistakes you're likely to make while typing and mistakes that either program is prone to make while recording your dictation. When I make a typing error, it's usually because I've misspelled a word. These are errors that can be caught by a word processor's spell checker. (And with Microsoft Word, they're flagged as I type them.)

On the other hand, speech recognition software can only type words that are in its dictionary. That means that when you use this software, each word is spelled correctly—even if it is the wrong word. That in turn means your spell checker will not be able to identify the error. So in the end, you have to proofread your documents much more carefully than if you had typed them yourself.

Both programs include extra software that allows you to use voice commands to operate your system. For example, issuing the command "open" automatically selects the Open command from the File menu. This isn't quite as easy as it seems. For example, suppose you're dictating using ViaVoice and you want to save your document. First, you say "stop dictation." Then you have to wait for a friendly voice to tell you "dictation stopped." Only after you hear that voice can you issue another command, like "save."

Now think about how long it takes from the time you decide to save your document to the time your mouse pointer clicks on that File menu or icon on the program's toolbar. It's about a nanosecond. In my opinion, using speech recognition software for program navigation is more a hindrance than a help, at least in the software's current state.

A very handy feature offered by both programs is the ability to create voice macros for boilerplate text. If there's certain text that you find yourself typing again and again, you can enter it all with a single voice command.

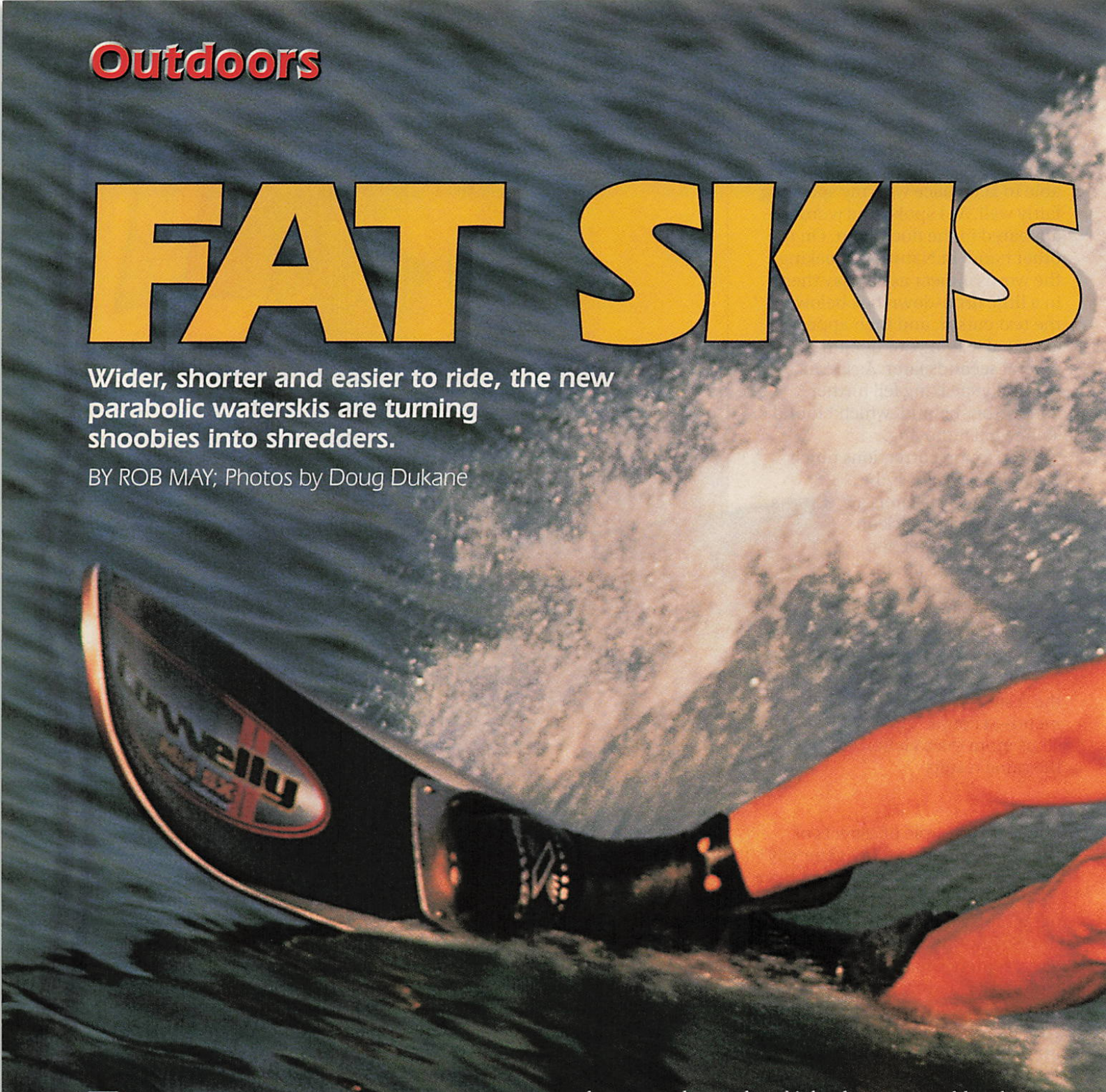
One of the most noteworthy differences between ViaVoice Gold and NaturallySpeaking Deluxe is their respective price tags. Both companies offer scaled down versions for about $100. These less-expensive programs do not include all the features I've mentioned. If you want the whole enchilada from IBM, you only have to spend an extra $50—ViaVoice Gold sells for about $150.

Dragon Systems is not so generous. The NaturallySpeaking Deluxe package that I reviewed sells for $695. Ouch! Is speech recognition software worth $700? Is it even worth $100? It could be a valuable tool in some niche markets, e.g. legal and medical professionals as well as for the physically challenged. And if you simply abhor typing, but can't afford to hire a secretary, it may be a viable option. However, for the mainstream computer user, the technology just isn't quite there yet. Maybe next time around. **PM**

FAT SKIS

Wider, shorter and easier to ride, the new parabolic waterskis are turning shoobies into shredders.

BY ROB MAY; Photos by Doug Dukane



The essence of waterskiing, especially slalom skiing, is skimming across unrumpled lakes. It's having nothing more than a sliver of fiberglass between yourself and the cool blue depths. It's carving hard turns and kicking up a 15-ft.-high wall of water while your friends, relatives and potential girlfriends look on in amazement.

At least that's what it used to be.

That's not to say waterskiing changed. The point is, waterskiing stayed exactly the same. Getting up on one ski could still cause the handle to fly out of your hands. Torrents of water could shoot up your nose. And the yank of the boat could inflict a painful divorce from ligaments and tendons that felt you obviously no longer loved them.

WATERSKIING

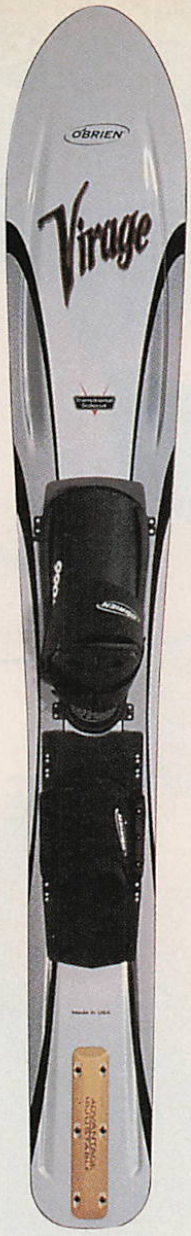
What *did* change were the waterskiers. Many baby boomers who used to ski the day away could no longer hack it. Younger skiers switched to the less taxing, more radical pleasures of wakeboarding. Waterskiing was on the wane.

Then it happened. Ski designers took a page from other popular sports and developed oversize equipment that reduces the backbreaking effort and restores the pure joy of the sport. These new skis help skiers pop up out of the water, carve like Martha Stewart on Thanksgiving, and take long endurance-stretching runs without first making sure a case of BenGay is available.

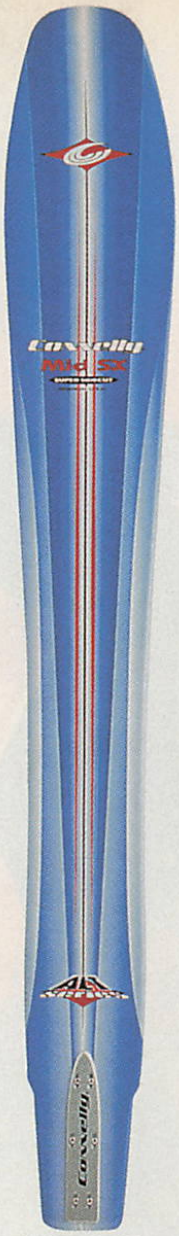
Call them what you will—shaped, parabolic, super-sidecut, wide, alternative, whatever—the secret to the new skis is in the shape. On average, a traditional ski is 66 to 72 in. long, 6.5 in. wide in the forebody and 2.5 in. wide at the tail. The new skis are 59 to 65 in. long, at least 9 in. wide in the forebody and 4 to 6 in. wide in the tail. In other words, they're shorter, wider, and have a parabolic footprint.

CONNELLY
Malibu

HO
RADIUS



O'BRIEN
VIRAGE



CONNELLY
MID SX

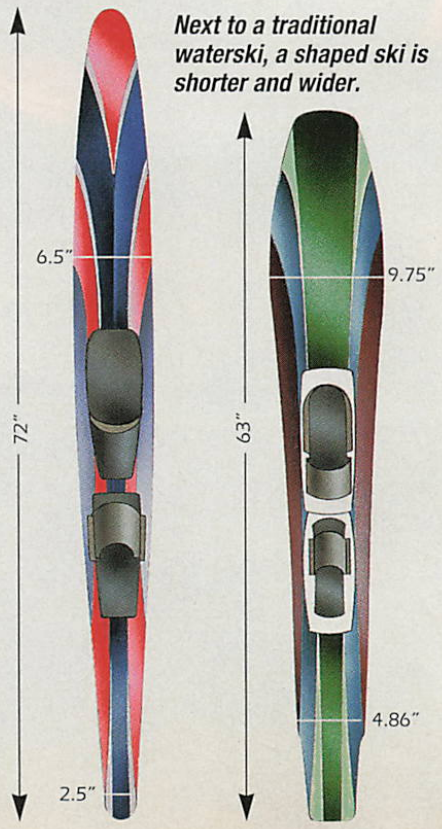
ICONN POWER
CARV

The most obvious advantage of these voluptuous new proportions is seen during startup. The hydrodynamics are simple: Narrow ski tips have less surface area, and therefore require more speed and force to displace enough water to get skiers on top. With their wide bodies, especially in the tips, the new skis displace much more water, which means less of everything is required—skier effort, boat horsepower and athletic ability. "With so much surface area up front," says Robert Stephens, an associate editor at *Waterski Magazine*, "a wide ski turns skiers from rocks to corks."

Even after startup, the extra displacement helps make skiing more enjoyable. Traditional skis are extremely tiring to ride because on average they only offer about 350 sq. in. of surface area. That usually forces skiers to ski at speeds faster than 30 mph to keep the ski afloat. New designs, with their incredibly large surface areas, allow most skiers to ski in the 24-to-28-mph range, which greatly reduces the strain on your body.

Some of that extra surface area is found in the tail, where the wider-is-better theory also applies. On most new designs, the tail is nearly 2 in. wider than on a traditional

On shaped skis, slow gradual turns are easy, yet hard carves are still possible.



Next to a traditional waterski, a shaped ski is shorter and wider.

ILLUSTRATION BY ADOLPH E. BROTMAN

Now, you can take long endurance-stretching runs without first making sure a case of BenGay is available.

slalom ski. Besides contributing to the overall surface area that allows skiing at slower speeds, the wider, more rectangular tail makes the ski more stable—which should eliminate some of those oh-so-graceful faceplants from your repertoire.

While the ski that started the trend, the Connelly Big Easy, may have gone a little overboard with 700 sq. in. of surface area, newer designs like Connelly's Mid SX, the ICONN Power Carv, O'Brien Virage and HO Radius have found a happy medium. At around 500 sq. in., these skis displace a lot of water and spread a skier's weight over a large area. But if it were strictly a matter of surface area, a 2 × 6 might make a good ski—and that's not the case.

What separates the new skis from mere planks is what the designers refer to as an hourglass, or parabolic, shape. As on many of today's downhill snow skis, the wide tip and tail taper into a narrower midsection. When placed on edge, this sidecut allows the ski to carve and grab angle like a traditional slalom ski.

Also, the amount of curve from front to back, known as rocker, is on average 0.5 in. shallower on the new skis. Combined with the parabolic shape, the reduced rocker allows the skier to initiate a slalom turn with ease. Lean slightly to one side, and the ski's shape effortlessly carves a gradual arc that can be ridden passively (letting the ski turn by itself) or aggressively (forcing it around the turn), although not as aggressively as a traditional ski. Either way, the ski remains stable and in control.

For former ski bums who thought they'd hollered their last "Hit it," and thrill-seeking wakeboarders, the waterski has finally caught up to the '90s. The new skis are not only fun for everyone from 15 to 50 and beginner to expert, they're more accessible: Skiers can now get up behind low-powered outboards, jet boats and even personal watercraft. Now *that's* the essence of waterskiing. PM

Parabolic Primer

Here are the companies currently offering versions of the new shaped, or parabolic, skis:

Connelly Skis	425/775-5416
EP Watersports	706/342-1916
HO Sports	425/885-3505
ICONN Sports	425/349-1550
Jobe Ski Corp.	425/885-3977
KD Water Skis	206/735-9226
O'Brien International	425/881-5900

Super-Size Me

Although hourglass, or super-sidecut, snow skis came first, the similar development in waterskis wasn't simply a case of copycat design. It followed a more traditional evolution, starting with the Big Easy in 1996.

If nothing else, the ski is aptly named: It has a massive 700 sq. in. of surface area, and it's incredibly easy to ride. It came about because Connelly wanted to bring back the "sometimes" skier (adults who used to ski a lot, when they had more stamina and fewer love handles). "We knew skiers were getting older and having a more difficult time starting and skiing for longer periods," says Connelly senior vice president Gordy Holmes, "and the Big Easy met their needs."

Understanding those needs led Connelly to put a hefty 11.5 in. into the forebody of the ski, compared to a traditional slalom, whose tip is around 6 to 7 in. wide. The big front was the key to easier deep-water starts, while the immense tail (6.88 in. wide—almost 4 in. wider than a competition model), kept skiers afloat at lower speeds.

The result was a ski that exceeded the Lynnwood, Wash., company's highest expectations, and opened the eyes of the waterski industry. In its first year, Big Easy sales nearly matched the number of Connelly's traditional slalom skis sold, and since then the industry has moved toward wider, more skiable shapes. Only two years after the Big Easy made its splash, there are more than 15 shaped skis on the market. And Connelly has kept pace with the competition: Its smaller and easier-turning Mid SX is one of the most popular skis in the oversize category. —*R.M.*

CONNELLY BIG EASY

MAKEOVER: CHRYSLER LEBARON

From junker to top-down jewel.

BY RICH TAYLOR; Photos by Jean Constantine

This homely tatterdemalion of an old convertible spent the past two years being passed from used car dealer to used car dealer across South Florida. But it's found new life as the second in our series of auto makeovers.

The first was our Oldsmobile Cutlass back in March. As we said then, our aim is not to do ground-up restorations and have 100-point collector cars. Rather, it's to take a somewhat dowdy and frayed older car and rejuvenate it, making it an inexpensive and fun ride. So, for $1500 we plucked this LeBaron from a lot full of Corvettes and exotic sports cars.

PROJECT CAR

What *were* we thinking? Well, for one thing, it's a convertible, so we knew it would be fun to drive—even if it is just a lowly Chrysler K-car.

And, for another, it's just a lowly K-car. Millions of Dodge, Plymouth and Chrysler models were built off this same basic platform, so parts and know-how are inexpensive and easy to come by. There are even turbocharged and racing versions, if you want to get carried away with hop-up parts.

Then there's the fact that, having spent its whole life in South Florida, this 14-year-old carried not one speck of rust. And at 94,000 miles it obviously hadn't been abused. We have friends who've put 250,000 miles on K-cars without doing much more than change the oil, so the reliability of the mechanicals is pretty well docu-

BEFORE

mented. No scary surprises lurking anywhere here.

Also, in its day, this was a top-of-the-line Chrysler, so it was equipped with every luxury feature available back then, including a/c, power windows, power top, 6-way power seat and a bucket-seat interior with console shifter.

Finally, every dealer who owned the car put some money into it. It had a new top, rebuilt MacPherson struts, a fancy sound system and a lot of new parts in the engine compartment. It even had new tires, albeit the wrong size.

There's a lesson here. Where other people saw just a ratty old K-car, we saw a gem that could be polished up. Maybe not a diamond—more like a zircon in the rough—but still a car that had another 100,000 miles of cheap fun left in it. On Wall Street, this is called being a contrarian, and a lot of successful people have made their fortunes by betting against the crowd.

We're not saying you should invest in Chrysler K-cars, Lord knows. What we are saying is that the concept of buying a car that nobody else wants, but one that's cheap and easy to fix up, is a perfectly valid way to have a lot of fun, learn some basic auto mechanics and drive a car you might not otherwise be able to afford. A 1998 Chrysler Sebring convertible, for example, costs almost 20 times what we paid for this old LeBaron. But 95% of the time—like when you're cruising to the ice cream stand on a soft summer night, top down and radio blasting—the LeBaron is the Sebring's functional equivalent.

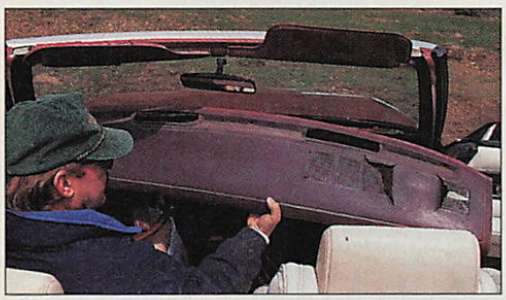
When we got our LeBaron home, family and neigh-

Millions of cars were built off this same basic platform, so parts and know-how are inexpensive and easy to come by.

We prepped the car before painting to ensure a good look.

bors were quick to make rude remarks. We stoically ignored them. We degreased the engine compartment and chassis, put the LeBaron up on jackstands and went through it from stem to stern, looking for mechanical problems.

We found surprisingly few. It needed spark plugs and wires,



The faded, cracked dash top was easily and cheaply replaced by one from the scrapyard.

fresh fluids and hoses, a new gasket between the exhaust manifold and exhaust pipe, a battery, taillight bulbs, a new muffler and brake shoes all around. For less than $400 in parts and a day's work, we had a convertible that started on the first kick, showed no smoke and drove as well as any 4-cylinder LeBaron ever drove.

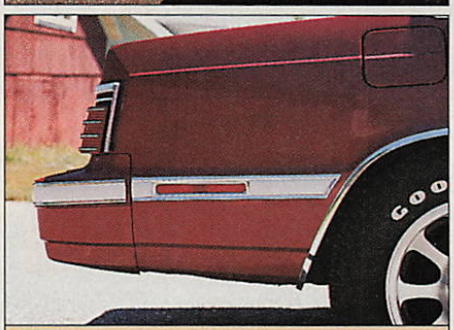
A few hours of wiping and spritzing with brake cleaner and Armor All, and we made the engine compartment shine like new. The Aquatred tires on stock steel wheels were offloaded to a friend—who put them on his minivan—and replaced with a set of proper-size Goodyear HP all-season tires mounted on American Racing alloy wheels that happened to be on sale at the local auto parts store for $49 apiece.

Next we attacked the formerly white bucket-seat interior. Simple Green and lacquer thinner turned out to be the most effective cleaning agents for taking off years of discoloration and ground-in grime. One of the things that attracted us to this particular car was the absence of rips or tears in the upholstery, so cleaning followed by a finish swipe with Armor All quickly made it good as new. We did splurge for a new white top boot to cover the retracted convertible top. This was still available from the local Chrysler dealer for less than $100.

The power windows didn't work, but that turned out to be nothing more than dirty contacts in the switches mounted in the driver's door. The dash top had been destroyed by a decade and a half of Florida sun, and the ashtray was gone. But this is one of a jillion K-cars, remember? A junked Chrysler sedan contributed its dash pad and ashtray for $5 and 10 minutes of work. Installing them in our convertible literally took less time than it takes to tell about it.

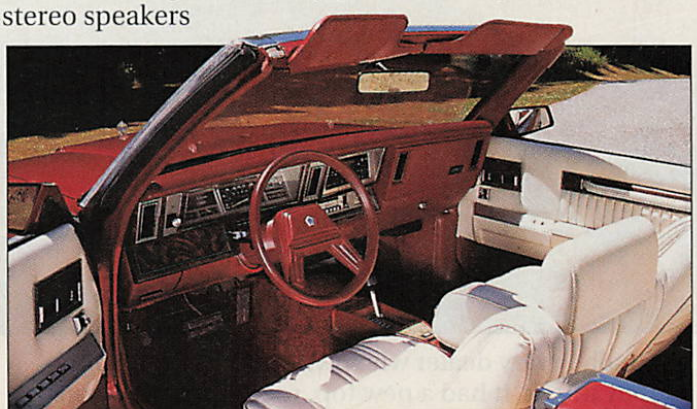
The convertible top had been professionally replaced, but a huge pair of aftermarket stereo speakers stuck into the top well prevented it from retracting. Removing the speakers not only allowed the top to go down but improved the sound reproduction of the radio, too. A quick scrubbing with Simple Green and Armor All restored the shiny blackness to the top and top frame.

Paint has become a real problem in low-buck auto makeovers. Ten years ago, you could get a "50/50" paint job—you know, one that looks good from 50 ft. away as the car drives by at 50 mph—for $300. A concours-quality paint job was $2000, *if* you had a friend in the business. Nowadays, at least in our neighborhood, a quickie respray in the same color costs $1000 and a quality paint job starts at $4000. A color change is at least $3000, and that's if you don't worry about color-matching the engine compartment or trunk.



Body damage was minimal, but replacing small trim pieces and bumper covers made a big difference.

Realistically, we should have either rubbed out the chalky white paint and been satisfied or done a backyard respray in the same color. As any professional painter will tell

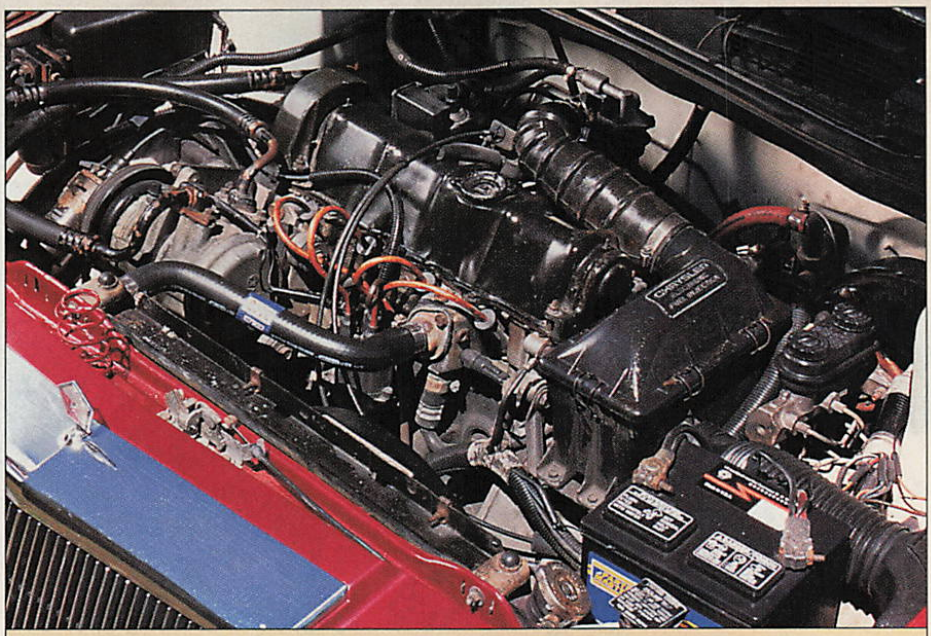


Since the upholstery wasn't cracked or torn, the interior responded wonderfully to a thorough cleaning and polishing.

you, the secret to a successful paint job is good preparation. In the past, we've actually prepped a car and painted it with spray cans from the hardware store. It works, though your finger gets numb from holding down those little nozzles all afternoon.

This time, we got it into our minds that the squarish LeBaron looked like a refrigerator in white. And who wants to drive around in an old refrigerator? After two false starts with paint shops that were so inexpensive they went out of business before they got around to us, we finally had the car painted by J&W Autobody, in Great Barrington, Mass. The color is a stock Chrysler dark strawberry metallic, and the paint job is superb.

On the one hand, this fancy paint job cost more than the car. On the other hand, particularly when set off by the polished alloy wheels, new stainless wheel-opening moldings and clean white interior, the paint makes the car. After the car came back from the paint shop, my neighbors literally didn't recognize it. They thought it was some convertible they'd never seen before—one that was at least 10 years newer. Was the color change worth it? Aesthetically, you bet. Financially, maybe not so much.



Basic tuneup, new fluids and hoses, and degreasing made the engine fine.

Add it all up, and we've got just over $4000 in this LeBaron. If we waited for the right person to come along, we could probably sell it through the local *Auto Trader* for that much or a little bit more. If we'd painted it in our own shop, of course, we could have made $1500 on the project. But that's not the point. Our LeBaron is good to go for another 14 years, and honestly shouldn't need anything except normal maintenance.

Even with our splurge on a paint job, $4000 and a weekend of work is still a lot less than the $27,000 Chrysler is asking for the 1998 equivalent of our LeBaron. It may have seem far-fetched at the beginning, but our auto makeover on an unwanted old convertible makes perfect sense from every point of view. Sometimes, you really can make a zircon shine like a diamond. At least from 50/50. **PM**

For Sale At Auction

PM's Chrysler LeBaron convertible can be yours. Now that we've had our fun refurbishing, refining and cruising around all summer in this little trick machine, we're going to auction it off.

Before deciding to bid, you should understand that this Chrysler LeBaron is not any hot rod. In fact, unlike our big-block Olds project car, the LeBaron has not been modified in any way. Rather, it was just brought back up to snuff. That means it rides, handles, accelerates and brakes just like any well-maintained mid-1980s front-wheel-drive, 4-cylinder car should. That said, the LeBaron is solid, well built and reliable.

The vehicle will be sold as is. No warranty or guarantee of any kind is expressed or implied. All taxes, license fees, insurance and other fees are the sole responsibility of the purchaser.

You can submit bids by mail to: Chrysler Auction, POPULAR MECHANICS, 224 W. 57th St., New York, NY 10019; or over the Internet via our Web site, the PMZone, at http://popularmechanics.com.

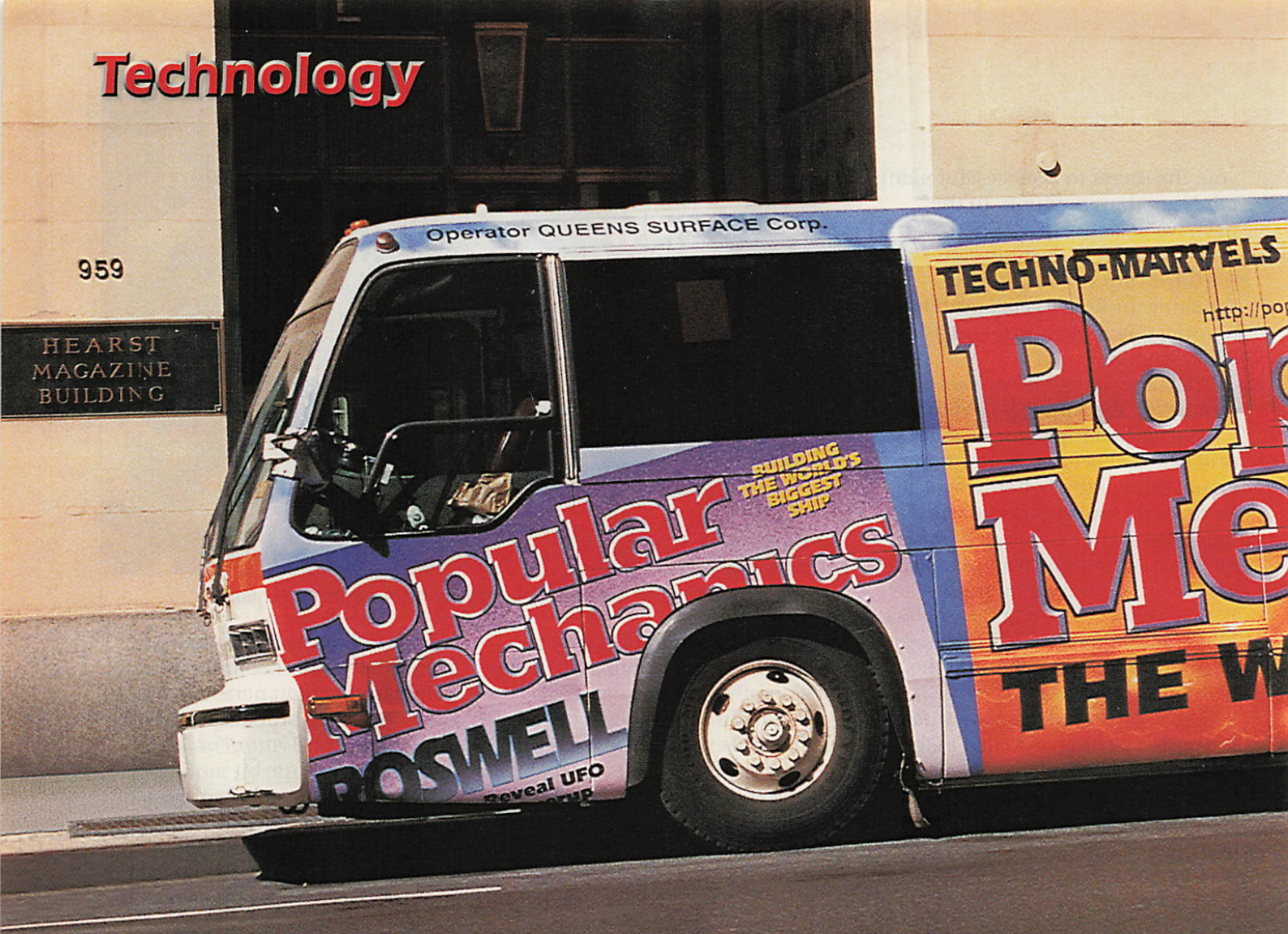
Minimum bid is $5000. So that we know you're serious, mailed bids must be accompanied by a photocopy of your valid driver's license and your home and work phone numbers. Bids accepted through our Web site must be followed up by mail with a copy of your driver's license and phone numbers.

The final bidding will take place on Monday, Nov. 16, 1998, at 2 pm. Before that date, you can follow the bidding on our Web site by clicking on What's Hot, then on Car Auction. We'll update the latest bids every day. Even if you're not a bidder, you'll want to be online to share in the excitement. Some lucky PM reader is going to drive off in our latest project car. It could be you.

SOURCE LIST

Some of the suppliers for this project:

- American Racing Equipment, 19067 S. Reyes Ave., Rancho Dominguez, CA 90221; 800-321-5489 (alloy wheels).
- Auto Sport, 130 Main St., Sharon, CT 06069; 860/364-5722 (auto service).
- Chrysler Corp., 1000 Chrysler Dr., Auburn Hills, MI 48326; 810/512-9300 (top boot stainless trim).
- Eagle Equipment Co., 23 Wetherill Place, Plainville, MA 02762; 800-535-0016 (lift).
- FBN, 339 Ashley Falls Rd.,Canaan, CT 06018; 860/824-0191 (exhaust system).
- Goodyear Tire and Rubber Co., P.O. Box 9125, Akron, OH 44305; 216/796-2490 (tires).
- J & W Autobody, 37 Church St., Great Barrington, MA 01230; 413/528-2495 (bodywork and paint).
- Minisport, Jackson Hill Rd., Sharon, CT 06069; 800-645-6069 (complete auto restoration).
- Wurth USA, 93 Grant St., Ramsey, NJ 07446; 800-526-5228 (nuts, bolts and other fasteners).



IT'S A WRAP

Giant graphics turn buses into rolling billboards.

BY CLIFF GROMER

Wrap 'n' roll. No doubt you've seen those rolling billboard buses emblazoned with huge images. It's where advertisers get more mileage for their message and where graphics meet gridlock. Even the bus windows are covered, provoking the question of whether passengers can see through them or are condemned to ride to their stop entombed inside a shadowy shrink-wrapped world.

HOW DID THEY DO THAT?

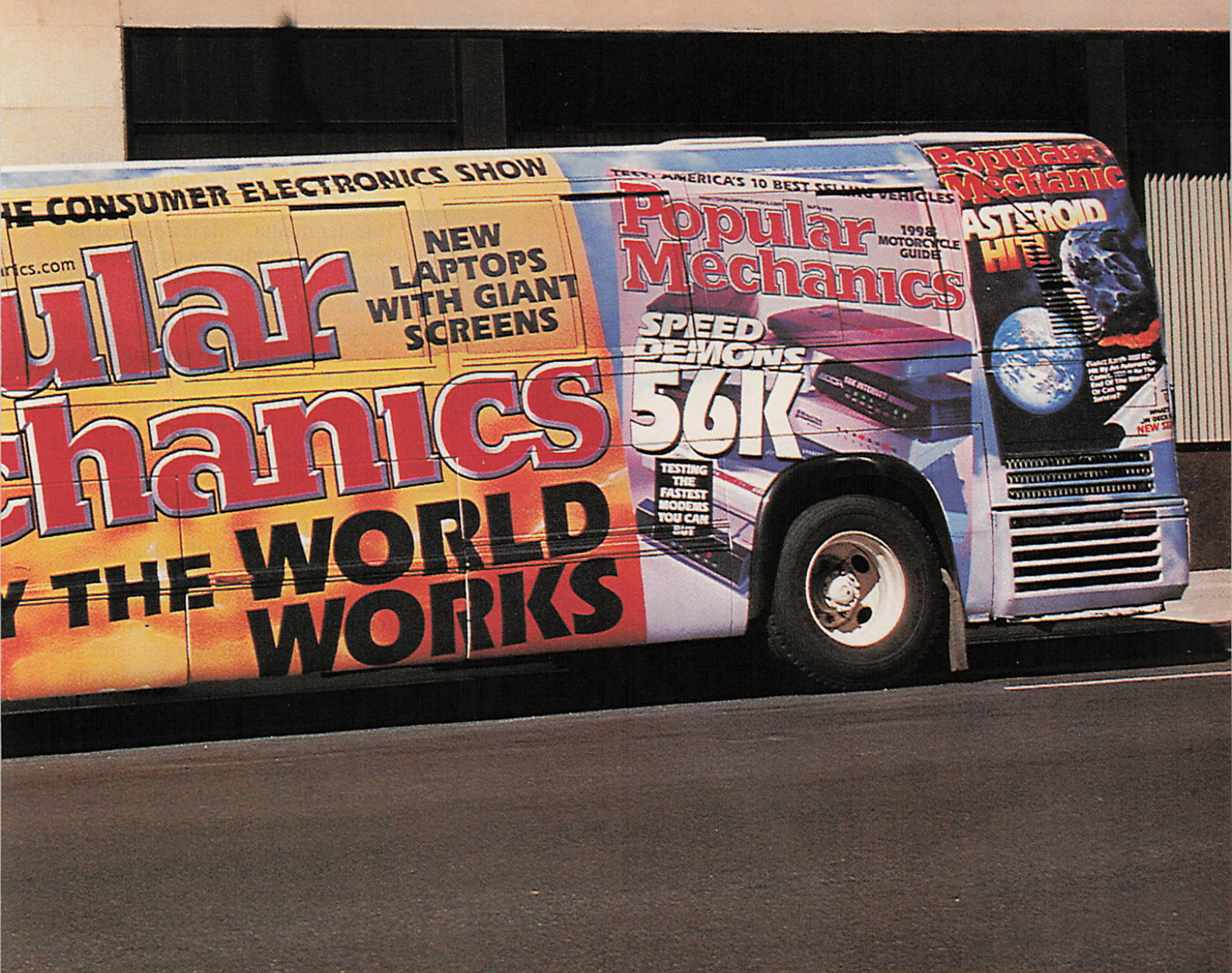
Rolling graphics are nothing new. For years, people have been airbrushing vinyl and applying it to trucks and buses or simply airbrushing the vehicle itself—a costly and very time-consuming process. Recent breakthroughs in computer hardware, software, vinyl materials and adhesives have streamlined the process to where a large number of buses can be wrapped—a process not unlike hanging wallpaper—quickly and cost-effectively.

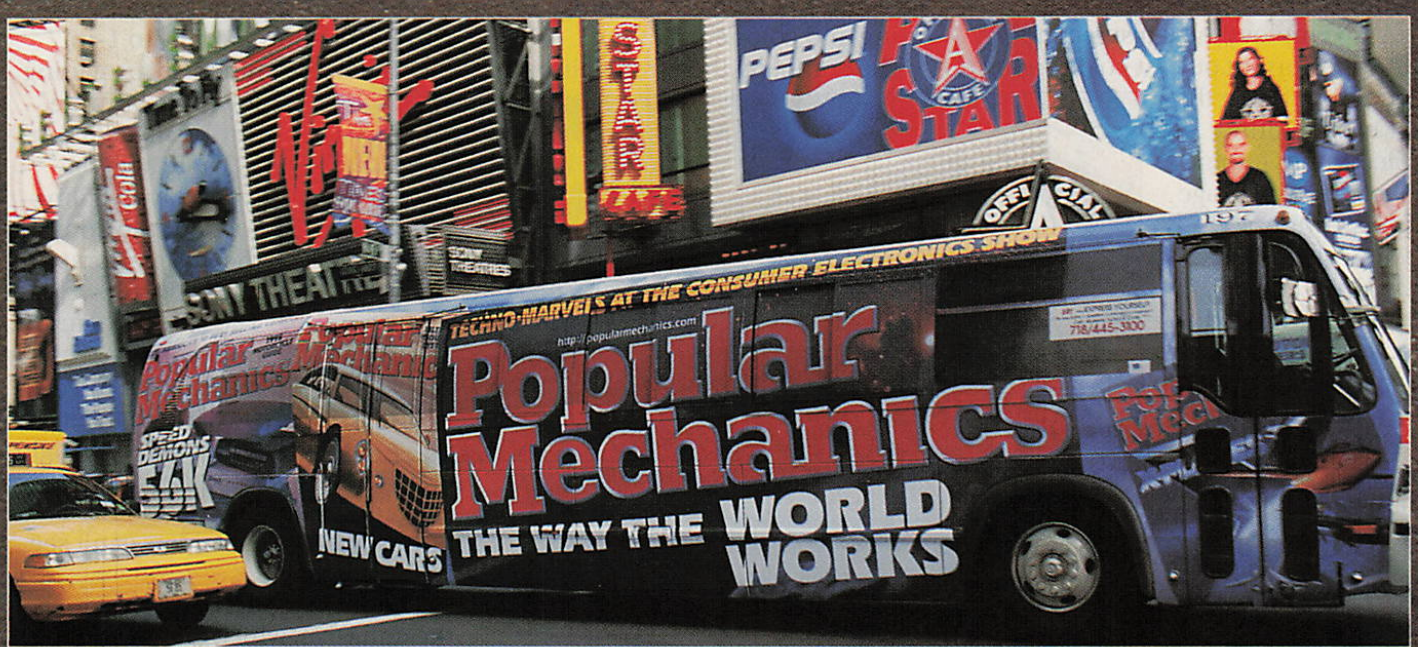
But this still doesn't answer the question of decorating the bus itself. Like, how do they do that?

To find out, we thought it would be fun to follow the process by having a bus wrapped with our own design—an in-your-face library of POPULAR MECHANICS magazine covers rolling down the avenue.

Our first stop, as it were, was Transportation Displays Inc. (TDI). This company has contracts with municipalities throughout the country to sell ad space on their buses. TDI will also recommend a production company, such as SuperGraphics, based in Sunnyvale, Calif., which helped with our project. TDI also recommended Queens Surface Inc. as the bus company that runs routes through Manhattan (one of our requirements), and

PHOTOS BY CLIFF GROMER





whose type of bus would look best with our proposed graphics. The cost for running a wrapped bus in New York, by the way, is $9500/month plus the cost of materials, production and installation.

SuperGraphics supplied PM Creative Director Bryan Canniff with a computer template of the bus showing which areas could and could not be covered.

Scanning in a selection of PM covers, Canniff came up with a design of magazine covers on a sky background that he fit into the template. No graphics were allowed on the front of the bus. For the rear, Canniff designed an image of the planet where PM and its parent company, The Hearst Corporation, are based, along with the new PM logo and the tag line "The

PM Creative Director Bryan Canniff designs the bus wrap graphics on his Mac computer using bus templates supplied by SuperGraphics. The completed disk is shipped back to SuperGraphics, which generates and sends back a printout. Corrections are made if needed, and the final layout is approved.

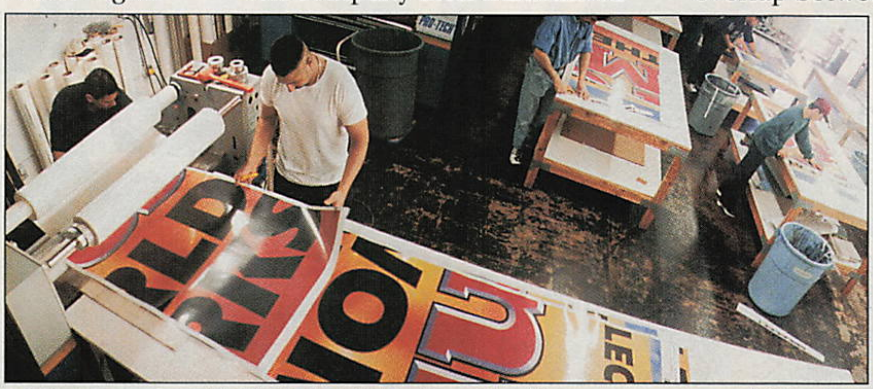
Way The World Works."

The completed template disk was shipped back to SuperGraphics, which employs the latest technology in wide-format output color digital graphics. Using the 3M Scotchprint Electronic Graphics System—a package of hardware, software, ultraviolet-resistant color toners, advanced color technology for electrostatic printers, laminates and adhesive systems—SuperGraphics opened up our digital template file and made adjustments such as cropping, sizing and color correction.

The company then transmitted the image to an electrostatic, single-pass, 4-color printer, which produced the graphic on Scotchprint transfer media. This is a special paper with a conductive coating that doesn't absorb the color toners. The printer lays down an electrical charge on the paper and the toners are laid on top of the coating. The transfer media is then fed through a thermal laminator that applies heat and pressure to transfer the image to Scotchprint pressure-sensitive adhesive film.

Finally, SuperGraphics ran the vinyl film through a cold-laminating machine that applied a clear vinyl top layer. This added another level of UV protection for the image, offered additional rigidity to the film and provided a measure of scuff and graffiti resistance. Any unwelcome artwork is easily removed with a citrus-based cleaner without affecting the graphic image underneath.

The printers can handle outputs that are 36 and 54 in. wide. A bus is 40 ft. long, so the graphics are run as separate panels, which also helps during installation. The exact number of panels depends on the particular bus. Our bus, ol' No. 197, is a Bridgeport RTS model that called for 67 different panels. The computer allows for 1/4- to 1-in. overlap between panels, providing for some latitude during installation.



There are two types of vinyl film—solid for the body of the bus, perforated for the windows. The latter is black on the inside with graphics on the outside. The film lets in about the same light as a 50% window tint and lets passengers see out. It functions as a one-way film as outsiders can't see into the bus.

SuperGraphics generates the bus wrap in panels. After being transferred to vinyl film, the image is protected by a clear top layer in a cold-laminating machine. All the panels are laid out and checked before shipping to the bus company for installation.

The slickest part of the system is the adhesive, which allows you to slap the panels on the bus and pull them off to reposition them as often as needed. Even if the film curls over on itself, sticky side to sticky side, it can be pulled apart. It's called positionable film, and it works by using a layer of micro-

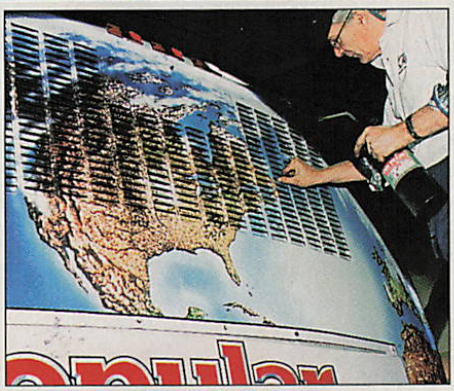
PHOTOS BY LANCE LOUGÉE/SUPERGRAPHICS (CENTER BOTTOM AND BOTTOM)

The windows have to be able to open and rattle, and the rear engine cover has to be able to be removed. All vents are slit.

scopic hollow glass spheres partially embedded in the adhesive surface. When the position is correct, the film is set with a squeegee. This breaks the glass spheres and gives the bus surface full contact with the adhesive. The film graphic will hold up to fading, peeling, cracking or shrinking for up to seven years. Yet it can be pulled off easily when the contract expires.

The printed panels were boxed and shipped to the bus company, where an approved independent installer, in our case, Applications Unlimited, was contracted to do the job. The usual drill is to strip a bus that has come off contract and wrap it with the new graphics. The job took three experienced men some 10 hours to complete.

The window film is one long panel that covers all the windows on one side of the bus. It is the first to be installed and it's positioned at the rear with the installers working to the front. All the other panels are registered to the window film. As the panels are applied, all seams have to be cut, as are openings for wheel wells, taillights and license plate. The windows have to be able to open and rattle, and the rear engine cover has to be able to be removed. All vents are slit and the vinyl around all bolt heads is cut with a round gasket cutter.



Installers apply window film first and key body panels to that. All engine vents must be slit, and a slight toasting of the wrap with a propane torch tightens the grip around irregular surfaces.

The vinyl is squeegeed out and uneven areas are gone over with a stiff brush. Lastly, all edges are heated with a propane torch, which helps set the adhesive and makes for tight corners.

So if you happen to be in New York City in the near future, look for the PM bus. Hail the driver and tell him you're a PM reader and you think his bus is cool. But don't expect a free ride. **PM**

PHOTO BY LANCE LOUGÉE/SUPERGRAPHICS (CENTER)

BETTER TO HEAR YOU WITH

Step-up computer audio systems are bringing killer sound to users.

BY JOHN GAFFNEY; Photo by Danilo Ducak

The sounds coming from your computer have certainly come a long way from the old Microsoft chimes and variations on "you have mail." Nowadays the PC is capable of delivering a lot more.

COMPUTERS

Through the Internet you can receive everything from a live press conference via CNN to a sampling of the latest R&B record on RealAudio to a classical piece from NPR. Through CD and CD-ROM technology built into most current PCs, you can listen to your favorite music while you work, or watch the kids play "NFL Quarterback" to a cheering virtual stadium.

The difference is exceptional sound. Today's PCs have the power and necessary connections to deliver this sound. What they don't have are the speakers.

PHOTOS BY KARL A. GEHRING/CORBIS (SCREEN INSET); STEVE JENNINGS/CORBIS (CROWD)

Most PCs don't sound better than the average clock radio. But new multimedia speakers deliver exceptional sound.

NEC/NXT FLAT-PANEL

Most PCs that have speakers built in (with some notable exceptions, such as IBM's Aptiva) don't sound much better than the average clock radio. But a new technologically efficient breed of multimedia speaker systems is now available. Invest in one of these systems and for the first time you'll hear the best sound your PC can produce.

In designing the new breed of multimedia speakers, engineers had to consider the different kinds of usage that came with the multimedia experience. Traditional audio speakers have had to meet a similar challenge. People started demanding more as surround sound, stereo TV and video music channels came to the fore.

To address that need, high-end speaker manufacturers such as Polk Audio, Bose and Cambridge Audio started to popularize the concept of bass modules and satellite speakers to give consumers more flexibility in positioning their video sound systems. That concept has been extended to multimedia. Now, PC users are starting to demand better-than-average sound from their multimedia experience.

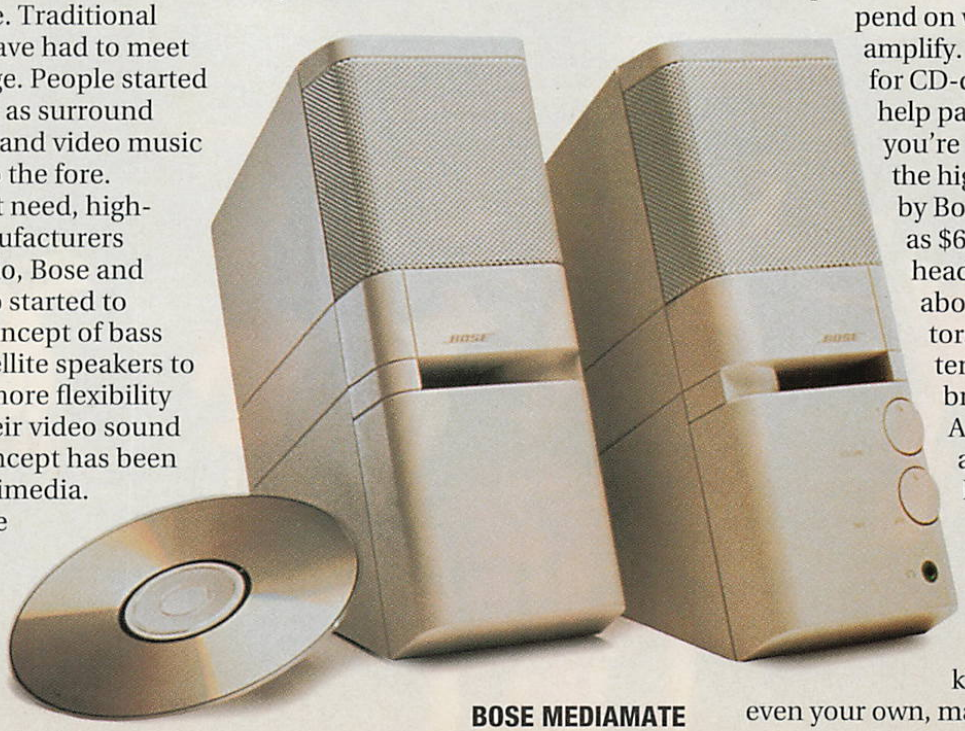
How Demand Was Met

Because multimedia is inherently a small, intimate experience, the current crop of computer audio systems comes in two categories. The low-priced to midpriced systems consist of two satellite speakers that attach to your PC's hard drive component. The higher-end systems consist of a bass module and two satellite speakers. The bass module serves as an amplifier for the satellite speakers, as well as for the bass speaker contained within. That amplifier for the entire system can often have complex features, depending on how much you want to spend on your system. For example, Bose's top-of-the-line Acoustimass multimedia system has an active digital equalizing circuit to maintain a good balance between bass and treble, which can sometimes become a nightmare in small spaces. "It takes care of some problems our ears have," says Nic Marks, general manager of Bose component audio.

Satellite speakers come in two categories. Some systems do not depend on a bass module to power them. Instead, they can connect directly to your computer. These speakers manage to cram treble and midrange speaker cones into a space sometimes less than 6 in. in diameter.

The companies that use satellite speakers have combined the trebles and midrange into a new "twibbler" speaker that makes the most of its small volume by capturing and processing high and midrange frequencies.

Computer audio systems come in varying price, size and quality levels. Your preference will most likely depend on what you need to amplify. If you're looking for CD-quality sound to help pass the time while you're working, look at the high end. Systems by Bose can run as high as $699—and sound head and shoulders above the competitors. However, systems from Cambridge Soundworks, Altec Lansing, JBL and others can deliver high-quality sound for $200 and less. If you plan on upgrading your sound system for the kids' game time, or even your own, make sure you get a


BOSE MEDIAMATE

system with a subwoofer or bass module. Games tend to run heavy on unpredictable and low-frequency sounds. If you want sound on your PC but don't want to pay big money, you can get a decent system for less than $100.

However, these days the problem with choosing a speaker system for the PC goes well beyond the systems themselves. The dilemma lies with the opportunity to receive digital audio broadcasts. Right now, digital audio on the Internet sounds almost as good as AM radio on a small transistor set. That's to say, it's not very good at all. However, increasing bandwidth is on the horizon for the Internet,

ALTEC LANSING

BOSE ACOUSTIMASS

and that will make digital audio broadcasts more feasible. In the shorter term, improving compression technology is expected to make digital audio a force over the next 12 to 18 months.

To position themselves at the center of this coming market, companies like Bose have decided to apply their research and might to the PC as the next frontier. But even they admit that consumer demand and consumer interest will determine how this technology will be developed and incorporated into the everyday PC. Right now the market is minuscule, but it's growing as users realize the potential of their PCs.

As an example of the goodies to come, ultrahigh-end-speaker manufacturer NXT has developed a flat-panel technology that has the potential to yield high-fidelity multimedia speakers with a minimum thickness of 1/64 in. using transducers to create complex vibrations—a dramatic departure from current speaker technology. And New Media Corp., of Irvine, Calif., has introduced a line of laptop speakers with extracurricular audio systems.

Whatever the applications are, past, present or future, computer audio is a lot like the PC itself. It gets more complicated every day.

Positioning

If you're going to spend the extra time and money to buy one of these systems, you should probably know how to put it together to get the best possible sound. Here are some tips on how to position the various elements of your computer audio system:

- If you have a bass module, put it on the floor—preferably in the corner of the room. This will ensure that the bass frequencies mix with the midrange and high-range frequencies, instead of overpowering them.
- Satellite speakers should be placed close to your monitor. This will provide the best performance from a small speaker. Just don't expect to hear the ultimate-quality sound when you're far away from your workstation. These speakers aren't built for that.
- Surface doesn't matter. The satellite speakers are built to perform on wood, plastic, formica or any other kind of synthetic surface. Even placing felt pads beneath them will not add much to the performance.
- Locate the ventilation openings in the bass module and make sure they're not blocked. The unit can overheat if it's not properly ventilated. By the same token, be careful not to put the bass module near any baseboard heating units.
- Experiment. Multimedia speaker systems are built to be flexible, which is why the components are easy to move. Your audio preferences will depend on what you use your computer for. If your main use is videogames, you may want the satellite speakers closer than someone who uses the computer to play audio CDs. Move the satellites and bass module around until you're satisfied you have the best quality. **PM**

KOSS HD-100

Home Improvement Journal

Top Gun

A well-crafted cherry cabinet for long arms and pistols.

BY ROSARIO CAPOTOSTO

SHOP PROJECT

Many firearms are laid flat and slid under a bed, or they are stood in a closet or buried in a drawer. Others are simply laid across bland-looking racks. It doesn't have to be that way. Firearms should be stored in a convenient and secure place that allows us to admire and handle them or easily remove them for hunting or target practice. We think this gun cabinet succeeds on all counts. Long arms are stood in the upper case, pistols displayed in the lower case. Supplies and ammunition may be stored in the two drawers below. With security in mind, the upper and lower doors are equipped with locks, as are the drawers. The glazing is impact-resistant acrylic sheet.

A gun cabinet can be an eye-catching piece of furniture, and we've designed this piece to be as elegant as anything else you would want to build. It's constructed of cherry plywood and solid cherry. The upper and lower cases are lighted with 20-watt, low-voltage halogen lamps. And the moldings, hardware and proportions all suggest refinement, not merely storage.

As projects go, this requires rather advanced skills. If you've already built a cabinet of one type or another, then it should be well within your capability. If you haven't built a cabinet yet, then study the plans and materials list carefully before beginning.

Case Construction

The gun cabinet is really two separate cases built from cherry plywood. To make each case look like it is built from solid lumber, edge bands are glued to the front edge of each case panel. The drawer fronts and doorframes are solid cherry.

The first step in case construction is to rough cut the plywood into smaller panels that you then cut to finished size on a table saw. The rough cut is made with a circular saw. Be sure to position the plywood so that the surface that will become the outside is facing down.

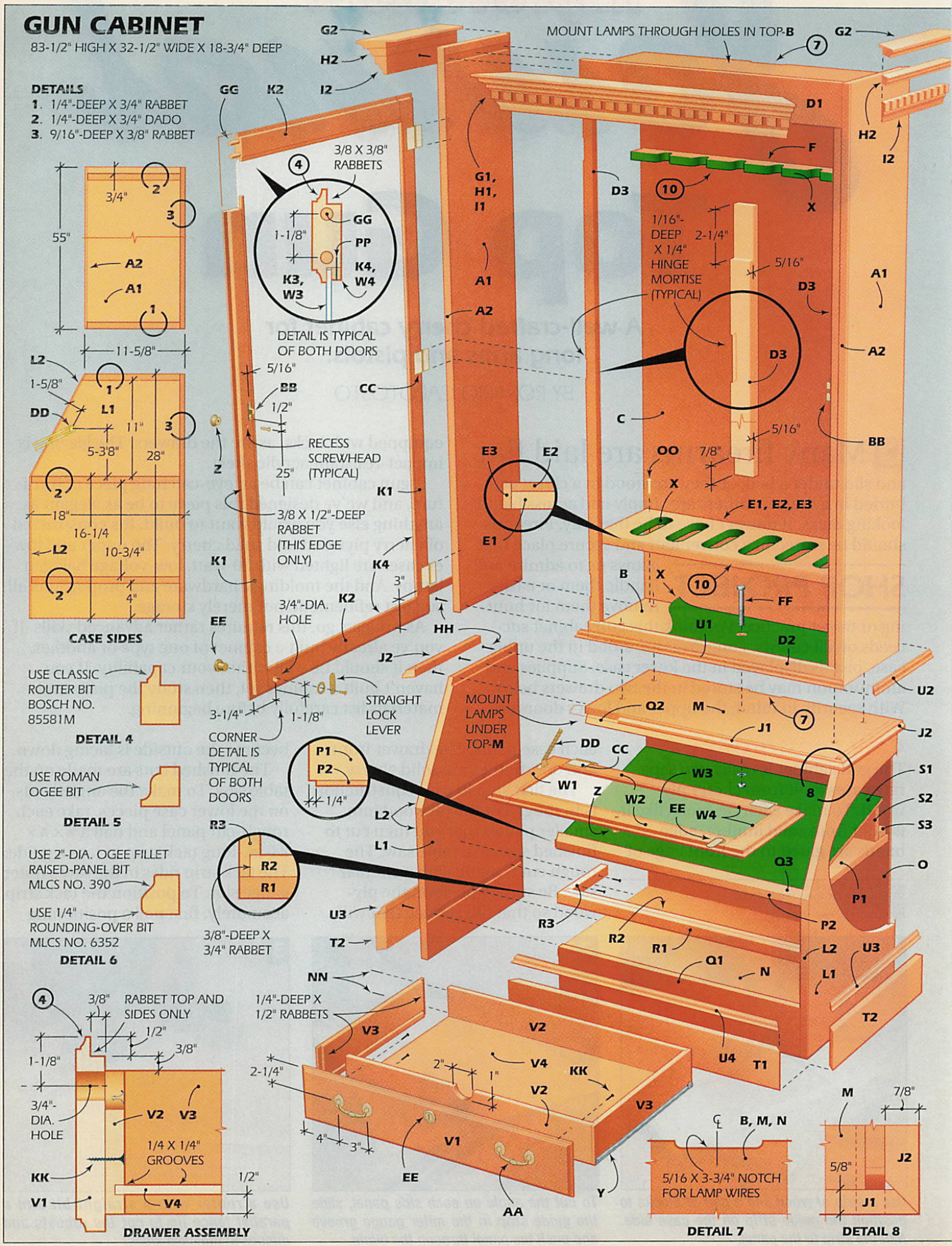
The finished cuts are made on the table saw. To make the angled cuts on the lower case pieces, take each rough-cut panel and nail a ⅜ × ¾ × 24-in.-long tack strip to it as a guide. The tack strip rides in the saw's miter gauge slot. To position the tack strip accurately, first nail a positioning

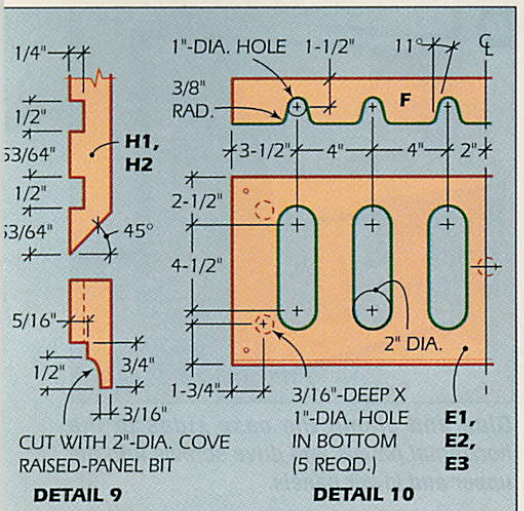
LEAD PHOTO: BRIAN KOSOFF
STEP-BY-STEP PHOTOS: ROSARIO CAPOTOSTO
TECHNICAL ART: EUGENE THOMPSON
PHOTO STYLIST: DEBBY ATKINSON

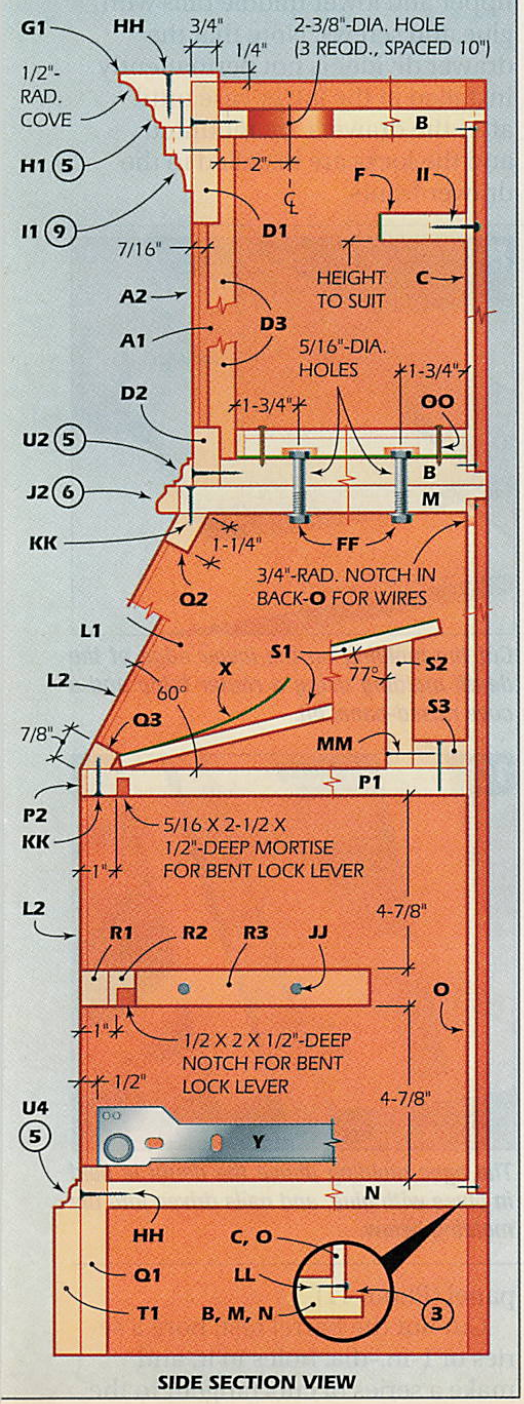
Use a strip of wood and a pair of blocks to position the guide strip on the case side. Nail the strip to the panel.

To cut the angle on each side panel, slide the guide strip in the miter gauge groove and push the panel through the blade.

Use a router with a straight bit and a parallel fence jig to cut the rabbets and dadoes in the case sides.


GUN CABINET
83-1/2" HIGH X 32-1/2" WIDE X 18-3/4" DEEP
DETAILS
1. 1/4"-DEEP X 3/4" RABBET
2. 1/4"-DEEP X 3/4" DADO
3. 9/16"-DEEP X 3/8" RABBET
CASE SIDES
DETAIL 4
USE CLASSIC ROUTER BIT BOSCH NO. 85581M
DETAIL 5
USE ROMAN OGEE BIT
DETAIL 6
USE 2"-DIA. OGEE FILLET RAISED-PANEL BIT MLCS NO. 390
USE 1/4" ROUNDING-OVER BIT MLCS NO. 6352
DRAWER ASSEMBLY
RABBET TOP AND SIDES ONLY
1/4"-DEEP X 1/2" RABBETS
3/8 X 3/8" RABBETS
DETAIL IS TYPICAL OF BOTH DOORS
RECESS SCREWHEAD (TYPICAL)
3/8 X 1/2"-DEEP RABBET (THIS EDGE ONLY)
3/4"-DIA. HOLE
STRAIGHT LOCK LEVER
CORNER DETAIL IS TYPICAL OF BOTH DOORS
3/8"-DEEP X 3/4" RABBET
MOUNT LAMPS THROUGH HOLES IN TOP-B
MOUNT LAMPS UNDER TOP-M
1/16"-DEEP X 1/4" HINGE MORTISE (TYPICAL)
5/16 X 3-3/4" NOTCH FOR LAMP WIRES
DETAIL 7
DETAIL 8





SIDE SECTION VIEW

strip to the panel and then butt spacer blocks to it. Butt the tack strip to the blocks, and nail it in place (Photo 1). Slide the tack strip into the miter gauge slot, and feed the panel through the blade (Photo 2).

The next step is to cut the dadoes and rabbets in the case panels with a router and straight bit. When cutting the dadoes for the horizontal panels, be sure to use a 23/32-in. straight bit because this is the actual thickness of ¾-in. plywood.

Mark the position of the dadoes on each side panel and make a dado jig to guide the router. Note that the jig uses a pair of guide rails that are spaced apart by a distance equal to the router's width. The two guide rails are fastened with crossrails at either end, and these are positioned so the panel slides snugly between them. Use the router and the panel to position the rails. To cut the dadoes, clamp the jig in place and run the router right through the crossrails at either end (Photo 3). This ensures a nice clean cut with no tearout at either end of the dado and a dado of the exact width needed.

Next, use a smooth-cutting blade to rip the edge strips. Cut them to finished length, apply glue to them and the panel edges, and then hold them in place with masking tape (Photo 4). Drive a tiny ½-in. 20-ga. brad near the end of each strip to help hold it in place. When the glue has dried, carefully plane the strips flush to the panel's surface, and use a chisel to cut the strip away at the top corner of the lower case (Photo 5).

Before assembling the case, remember to bore holes for the low-voltage lighting in the horizontal panels of the upper case. Also, make the crossrails for the upper case. The upper case sides, crossrails and horizontal panels are glued and clamped together. Drive screws through the case sides and into the horizontal panels. Do the same with

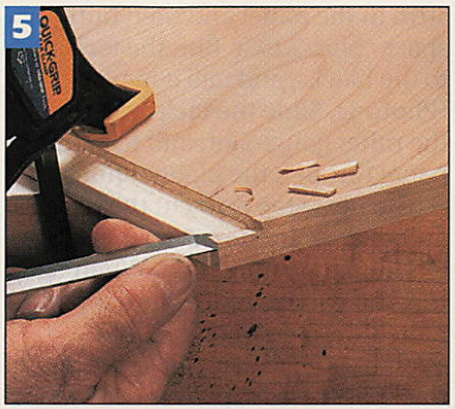
Materials List—Gun Cabinet

Key	No.	Size and description
A1	2	¾×11⅞×55" cherry plywood (side)
A2	2	⅜×¾×55" cherry (edge band)
B	2	¾×10⅞×27 ½" cherry ply. (top/bottom)
C	1	¼×27¾ ×53½" cherry plywood (back)
D1	1	¾×3⅞×27" cherry (rail)
D2	1	¾×1⅝×27" cherry (rail)
D3	2	¾×1×52¾" cherry (stiffener)
E1	1	½×9⅞×27" plywood (butt rest)
E2	1	¼×9⅞×27" plywood (butt rest)
E3	1	⅜×¾×27" cherry (edge band)
F	1	¾×2½×27" cherry (barrel rest)
G1	1	¾×2¾×32½" cherry (molding)
G2	2	¾×2¾×13⅜" cherry (molding)
H1	1	¾×1¼×31" cherry (molding)
H2	2	¾×1¼×12⅜" cherry (molding)
I1	1	¾×1¾×30" cherry (molding)
I2	2	¾×1¾×12⅜" cherry (molding)
J1	1	⅜×¾×30¼" cherry (molding)
J2	2	¾×⅞×12⅜" cherry (molding)
K1	2	¾×2⅜×50⅛" cherry (stile)
K2	2	¾×2⅜×22⅞" cherry (rail)
K3	1	⅛×23½×46" acrylic sheet
K4	1	¼×⅜×144" cherry (retainer)
L1	2	¾×17⅛×28" cherry plywood (side)
L2	1	⅜×¾×120" cherry (edge band)
M	1	¾×12×27" cherry plywood (top)
N	1	¾×17¼×27 ½" cherry plywood (bottom)
O	1	¼×23¼×27 ¾" cherry plywood (back)
P1	1	¾×17⅛×27½" plywood (shelf)
P2	1	⅛×¾×27" cherry (edge band)
Q1	1	¾×5⅛×27" cherry (rail)
Q2	1	¾×¼×27" cherry (rail)
Q3	1	¾×⅞×27" cherry (rail)
R1	1	¾×1×27" cherry (divider)
R2	1	¾×1×26¼" cherry (divider)
R3	2	¾×1×7¼" cherry (divider)
S1	1	⅜×16×26⅞" plywood (platform)
S2	1	¾×3⅜×26⅞" cherry (support)
S3	1	¾×1½×26⅞" cherry (cleat)
T1	1	¾×4×30" cherry (molding)
T2	2	¾×4×18¾" cherry (molding)
U1	1	½×¾×29½" cherry (molding)

Key	No.	Size and description
U2	2	½×¾×12¼" cherry (molding)
U3	2	½×¾×18½" cherry (molding)
U4	1	½×¾×29½" cherry (molding)
V1	2	¾×5×27⅞" cherry (drawer face)
V2	4	½×3 ¾×25½" plywood (drawer front/back)
V3	4	½×3 ¾×16" plywood (drawer side)
V4	2	¼×15½×25½" plywood (drawer bottom)
W1	2	¾×2⅜×11¼" cherry (stile)
W2	2	¾×2⅜×22⅞" cherry (rail)
W3	1	⅛×7⅛×23½" acrylic sheet
W4	1	¼×⅝×72" cherry (retainer)
X*	1	self-adhesive green felt, part GF 27
Y*	2	drawer slides, part GR 6040
Z*	2	door knobs, part SBH 88
AA*	2 pr.	drawer pulls, part SBH 83
BB#	1	twin-ball catch, part LA 511 3 PB
CC#	3 pr.	hinges, part AO 7697 3
DD*	1	lid support, part 96J6
EE#	4	locks, part N8073 03 642
FF	5	⅝" carriage bolts
GG	16	⅝×2" dowels
HH	3	1½" No. 8 fh screws
II	3	1¼" No. 8 rh screws
JJ	4	1 ¼" No. 6 fh screws
KK	10	1" No. 6 drywall screws
LL	46	½" No. 6 pan head screws
MM	10	1 ½" finish nails
NN	40	1" finish nails
OO+	4	1" 18-ga. brass escutcheon pins, part 853-609
PP	63	⅝" 19-ga. nails

Misc: Watco Danish Oil, semigloss polyurethane, sandpaper, wood glue.
* Constantine's, 2050 Eastchester Rd., Bronx, NY 10461; 800-223-8087.
# Woodworker's Hardware, P.O. Box 180, Sauk Rapids, MN 56379; 800-383-0130.
+ Woodworker's Supply, 1108 North Glenn Rd., Casper, WY; 800-645-9292.

The edge banding is glued, and held in place using masking tape. A pair of brads in each band keeps it from slipping.



The edge banding blocks the rabbet at the top of the lower case. Use a chisel to pare away the edge band at this point.

Glue and clamp the case sides to the horizontal panels and drive screws into the upper and lower panels.

the lower case—in both instances the screws will be hidden by the moldings. Mark, cut and install the stiffeners in the upper case. Note that the stiffeners are notched behind the top rail and the left one is mortised to clear the hinge leaf. Cut and temporarily install the back panel, and then cut the shallow wiring recess in the top horizontal panel.

Glue, clamp and screw the lower case sides to the horizontal panels (Photo 6). Next, attach the beveled upper and lower middle rails with glue and screws. Note that the drawer divider is not permanently installed in the lower case until after the drawers are mounted and the locks are installed in the drawer fronts.

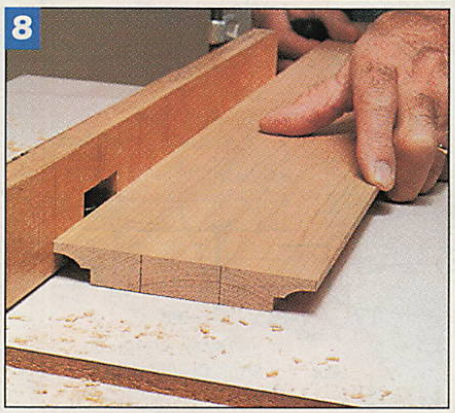
Moldings

The cabinet's dentil molding is made with a router and a ½-in.-dia. straight bit. Bolt a fence to the router's base 53/64 in. from the bit. Rip the molding stock and joint its edges so they are parallel and the ends square. Make the first dado cut, move the fence into the groove, make the second cut and continue on in this fashion until the molding is complete (Photo 7). Make several passes on the router table to cut the thumbnail molding on the dentil's lower edge (Photo 8). Cut the rest of the moldings for the cabinet on the router table, then rip them off on the table saw (Photo 9).

Attach the moldings to the case, beginning with the dentil. Clamp it in place, and mark its miters. Bore pilot holes in it for alignment nails. Glue and clamp the molding and drive the nails through it. Attach the side dentil moldings in the same sequence.

To apply the ogee molding above the dentil, follow the same sequence, but don't nail the molding to the case. Attach it to the dentil molding with nails from above (Photo 10).

The dentil molding is cut using a router with a guide strip screwed to its base. The strip rides in the previously cut dado.



Cut the molding on the lower edge of the dentil molding using a router table and a cove raised-panel bit.

Cut the ogee moldings on the edge of a wide board, then rip the molding off the board on the table saw.

The ogee molding above the dentil is held in place with glue, and nails driven into the molding below.

Supports, Doors, Drawers And Lighting

Make the butt-rest panel, then bore 2-in.-dia. holes in it, and saw out the waste between them. Trim the cutouts using a router and flush-trimming bit. Run the router against a plywood fence clamped to the panel (Photo 11).

Cut out the barrel rest, bore a series of 1-in.-dia. holes in it, and make a series of cuts tangent to the

holes using a sabre saw. Make the pistol platform, cover it with felt and leave it aside to be installed after the cabinet is finished.

Next, rip and crosscut the door rails and stiles. Mark the centerlines on the pieces, and use a dowel jig to bore holes in either the rails or the stiles. Insert dowel centers in the holes and align the parts using a framing square. Press the parts together (Photo 12), and use a dowel jig to bore holes on the marks (Photo 13). Insert dowels in the holes, then glue and clamp the assembly. Sand the doors using a random-orbit oscillating sander (Photo 14).

Cut the glazing rabbets inside the doors, and cut the molded edges on them. Cut the door's glazing strips, and round the strip ends to fit the rabbets. Buy acrylic glazing cut to size, then sand the glazing's corners to fit the rabbets. Install the glazing after the case is finished.

Now, lay the upper and lower cases on their backs, and temporarily install the door hinges. Lay each door in place over the hinge. Press down on the door, so that a small dimple on the hinge marks the hinge's position on the door (Photo 15). Remove the door, and lay it on the workbench. Position a hinge on the dents and use the hinge as a template to bore the screwholes.

Rip, crosscut and joint the drawer parts, then cut the rabbets and grooves in the parts. Also cut a half circle in each drawer box for lock clearance. Glue and clamp the drawer boxes. Make the drawer fronts and bore a lock hole in each.

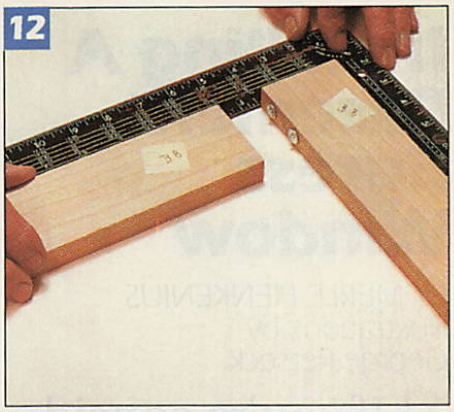
Install the drawer slides in the case per the manufacturer's directions. Mount each drawer box in its slides and drive four drywall screws through each drawer front. Hold the drawer front in front of the drawer boxes and press the drawer front against the drywall screws to mark the drawer front location on the box (Photo 16). Bore pilot holes on the marks, mount the locks on the drawer fronts, and install the drawer fronts.

Mark the location of the lock cam levers on the drawer divider and on the bottom of the pistol compartment shelf. Remove the divider and shelf, and then cut the mortises to accommodate the lock cam lever. Reinstall the divider.

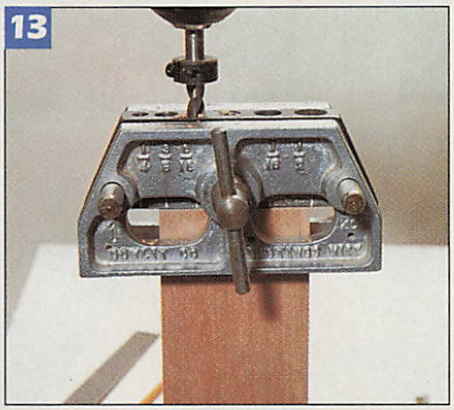
Now stack the cases, clamp them together and bore holes for the connecting bolts. Bolt the two cases together and carefully finish-sand. We applied two coats of Watco Cherry Danish Oil Finish, followed by two coats of semigloss polyurethane. The finish was applied on the doors, drawers and case assembly separately. Install these components after you are through applying finish on them. The pistol compartment shelf, the glazing in the doors, the gun supports and the plywood back panels are installed after finishing.

The final touch is to install two 3-light, 20-watt halogen Combilight kits. The product is sold at home centers and lighting showrooms. To locate a distributor, contact Lusa Lighting, 26235 Technology Dr., Valencia, CA 91355; 800-779-2946. PM

Smooth the slots in the butt rest using a flush-trimming bit and a router. Run the router along a fence clamped in place.

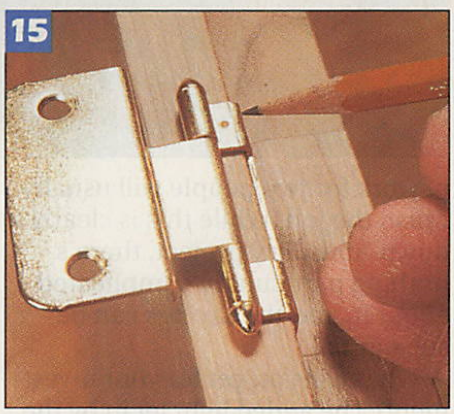


With dowel centers inserted, press the door parts together while aligning them with a framing square.



Use the marks created by the dowel centers to position the dowel jig. Bore the remaining dowel holes.

Sanding door rails and stiles can be tricky. Use a random-orbit oscillating sander to avoid crossgrain sanding.

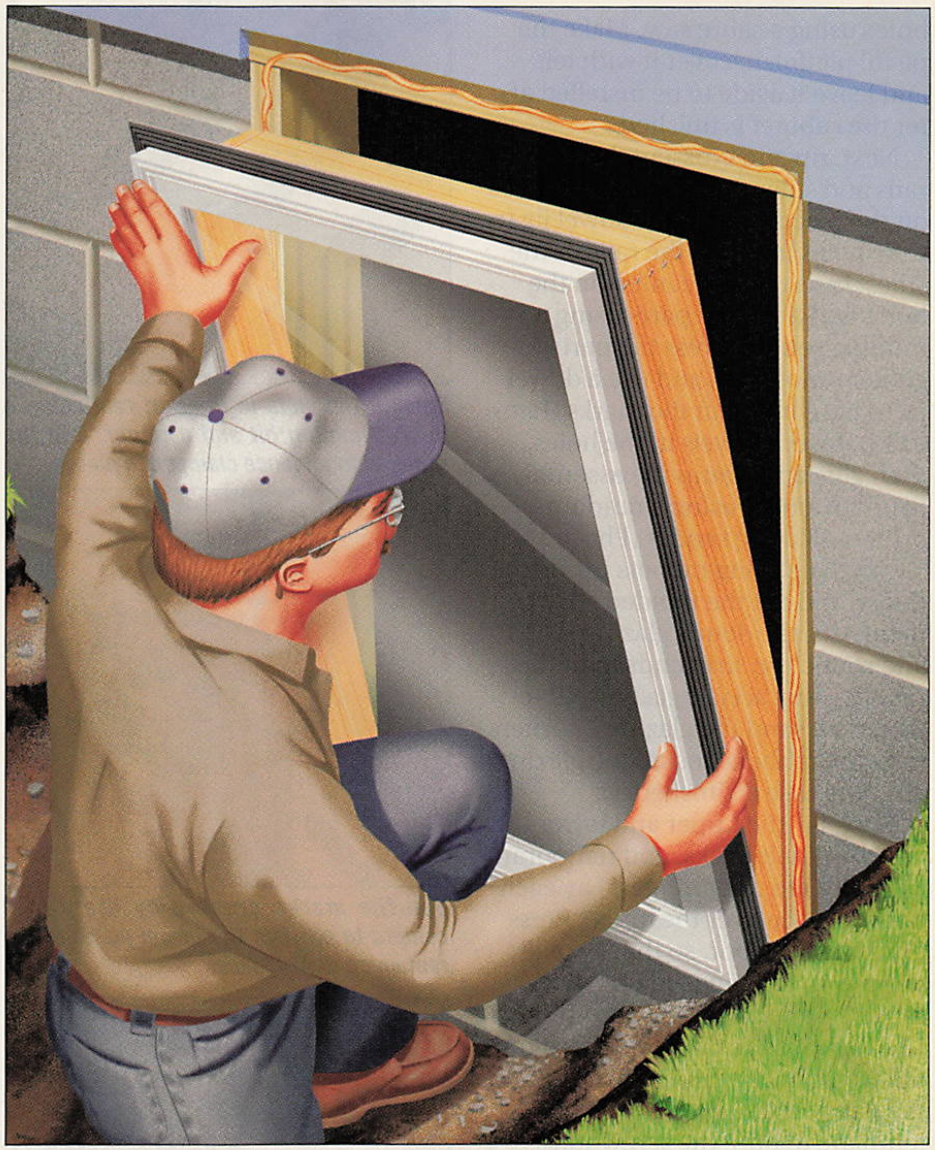


Small dimples on the hinges will mark the location of the screwholes when the door is pressed on top of them.

Press each drawer face onto its drawer box. Four screws driven through the box make registration marks on the drawer face.

Installing A Basement Egress Window

BY MERLE HENKENIUS
Illustrations by
George Retseck



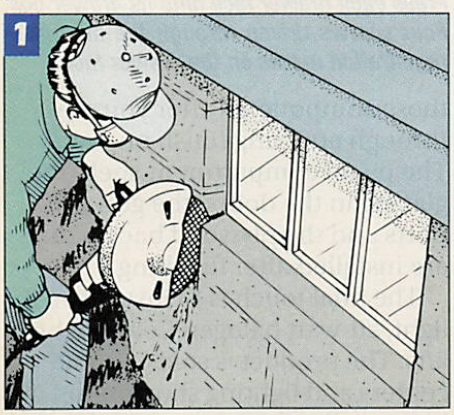
If you're considering a basement renovation as a way to expand your living space, don't be surprised if your building-codes office has something to say about it—especially if a new bedroom is part of your plan. Without an egress window in case of fire, regulations simply won't allow a basement bedroom. And because this ruling is fairly recent in many parts of the country, most existing basements were not built with egress windows. It's a conundrum that could keep you cramped for space, with all the space you need right under your feet.

HOME IMPROVEMENT

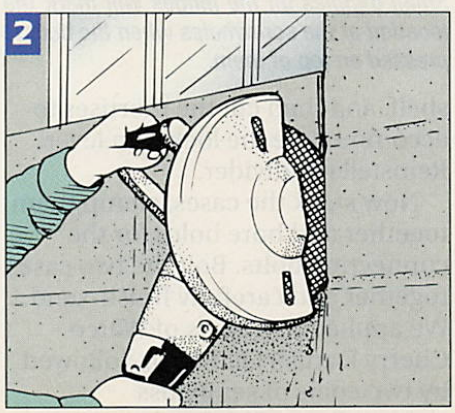
Thankfully, you needn't be restricted by the basement your house was built with. You can solve the problem by cutting a large opening in a basement wall and adding a window that meets code requirements for egress. You'll find contractors willing to do this work, often for between $2000 and $3000, or you might consider doing it yourself. About $500 and two days of work for two people will usually finish the job. While this is clearly a down-and-dirty project, there's nothing particularly complicated about it, and the savings can be substantial.

What will you get for your investment? The added light let in by the new, deep window can eliminate the dark and dank atmosphere so common to earlier basement finishes. The sensory difference can be remarkable. In basements, more than anywhere else, light is a critical design element.

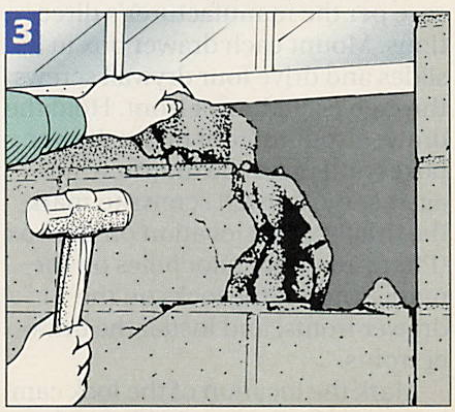
Of course, the primary benefit of a



After digging a large hole for the window well, mark the opening and begin cutting with a demolition saw.



Inside the basement, mark the opening outline to match the outside and cut the wall about 1 in. deep.



Knock the blocks away with a 3-pound hammer. Use a cold chisel to remove chunks of mortar that remain.

deep window is egress—an easily accessible opening through which you can escape or a firefighter can enter in the event of a basement fire. Basement fires are common, so this is really more than a code issue. And of course, what's good for you will be good for the next owner as well. With an extra legal bedroom, you could recover 10 to 20 times your window installation costs when you eventually sell your home.

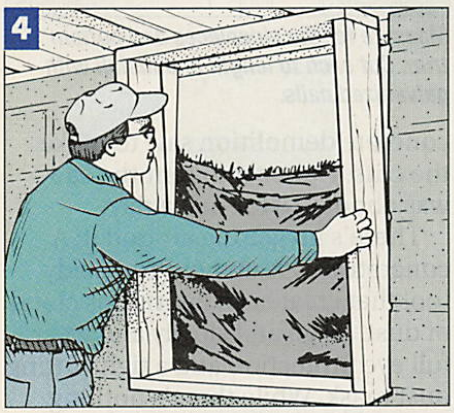
Code Requirements

Local regulations vary, so you'll need to start with a visit to your codes administration office. With minor variances, here's what you'll find.

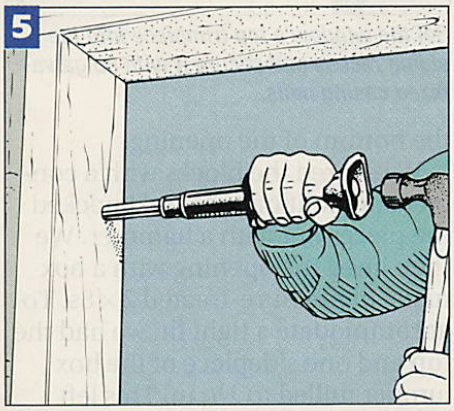
To begin, not all basement rooms need a legal egress window, but certainly no basement bedrooms will be allowed without one. And if it has occurred to you to call a given room a den before the inspection and a bedroom after, well, let's just say that this isn't a very original idea. Today, any bedroom-sized room with a closet is considered a bedroom, no matter what the blueprint says.

As for size requirements, expect to need a window with an opening of 5.7 sq. ft. Some codes count the glass area, while others measure the area with the window open. In any case, a vertical casement window with 6 sq. ft. of access is a good choice for a retrofit installation.

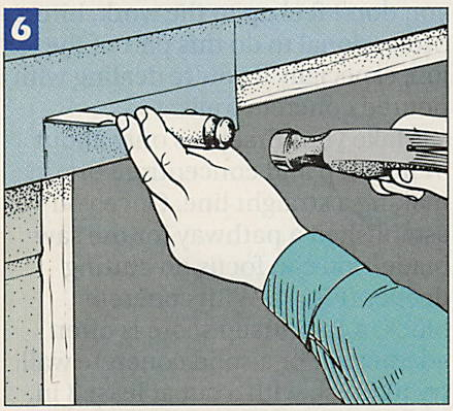
The height of the window installation is also important. The bottom of the window opening should be no more than 44 in. off the floor. Outside, an oversize window well is required. It will need to be at least 36 in. wide and extend 36 in. out from the window. The window well height is also limited to 44 in., as measured from the well floor. If a deep basement forces a deeper window well, most codes will allow a concrete block on the floor of the well to serve as a step, as long as it doesn't interfere with the window's opening.



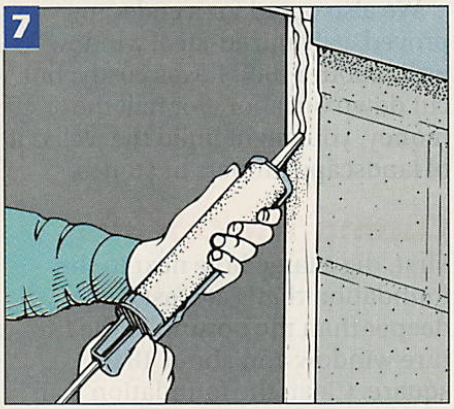
Build a window box with 2 × 8 pressure-treated lumber. Slide the box in the opening with construction adhesive at the seam.



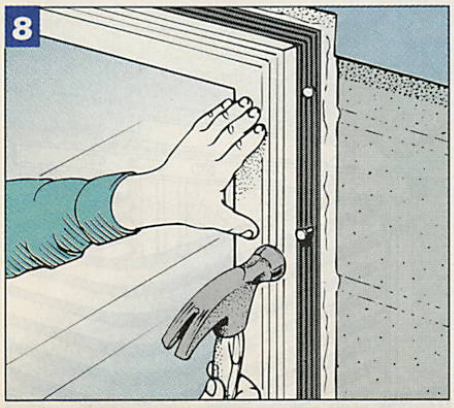
Nail the box to the sill above. Use concrete nails or a powder-loaded setting tool to secure the sides and bottom.



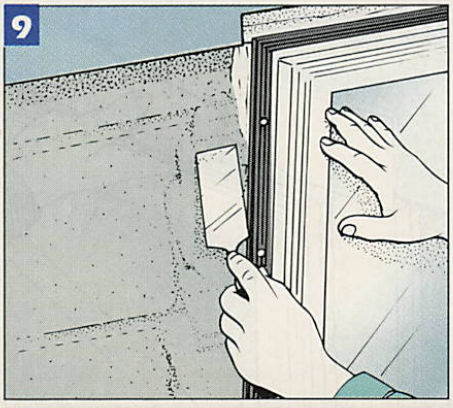
After cutting the siding with a circular saw to accept the top trimpiece, finish the corners with a sharp chisel.



Caulk the outer edge of the window box with a high-quality caulk before setting the window into the opening.



With a helper holding the window level on the inside, nail through the support fins to secure window to surrounding box.



Use premixed mortar to fill gaps or irregularities created in the demolition. Allow to set overnight before trimming.

Our Project And Yours

Our installation was part of a larger basement renovation in a 50-year-old, 2-bedroom home. We placed the egress window in a new basement bedroom, in place of an original small window. You don't have to work with an existing window, but it's vastly easier. Our walls were made of concrete blocks, which are substantially easier to cut than poured concrete walls. We limited the width of our window opening to the span of two blocks, or 32 in. To fit this opening, we chose a Pella ProLine model PCI-25, which is a vinyl-clad casement window (Pella Corp., 102 Main St., Pella, IA 50219). This window requires a 29 × 41-in. rough opening, and costs about $180.

A wider window would have required a structural header under the sill. The header would have lowered the placement of the window and created an exterior trim problem. Our block wall was topped with a 4-in. cap block, bringing the vertical dimension of our cutout equal to five 8-in.-high courses plus the cap block. Lacking the cap block at the top, you would need to cut down six courses and lay two 4-in. blocks in

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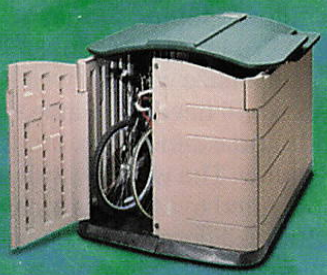

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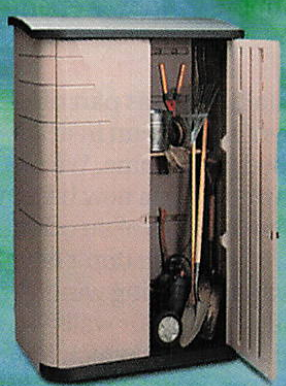

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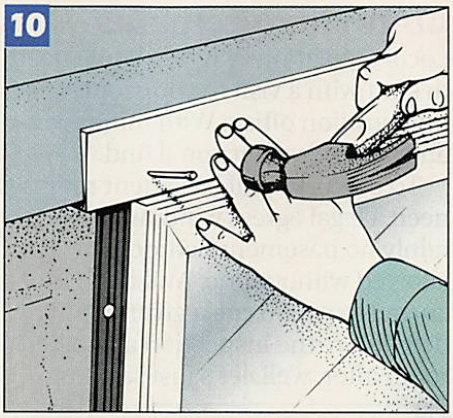
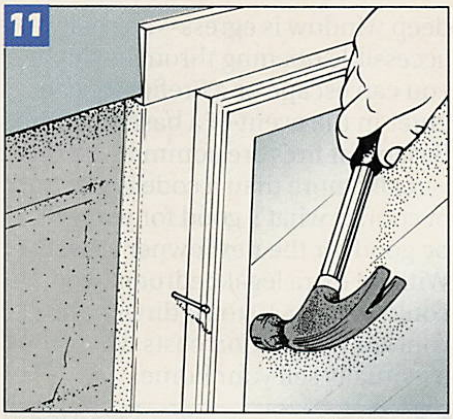


Set the window's top trimpiece into the siding recess and secure it with 8d galvanized casing nails.



Measure for the sidepieces and bottom trim. Cut each to length and install with galvanized nails.

the bottom of the opening.

We scored the blocks with a concrete demolition saw and knocked the pieces out with a hammer. We then lined the opening with a box made of pressure-treated 2 × 8s. To accommodate a tight fit, we had the top and one sidepiece of the box lumber milled to 1¼ in. This left enough room to slide the window in place and add insulation between the window frame and box.

We also opted for a code-approved, galvanized-steel window well (about $190). It was costly, but cut down on labor. For half the money, you might build the well out of landscape timbers or stones.

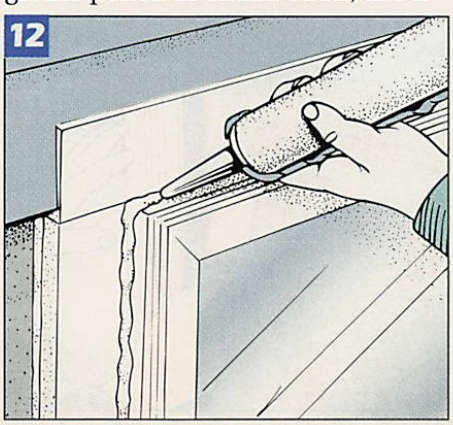
Cutting The Opening

First, dig a large hole next to the foundation that's at least 6 in. deeper than the bottom of the future window and about 48 in. square. Clean the foundation wall as best you can and mark the perimeter of the opening with a grease pencil or chalk. Then, use a concrete demolition saw to make the cuts. Our cost to rent the saw was about $18 for half a day.

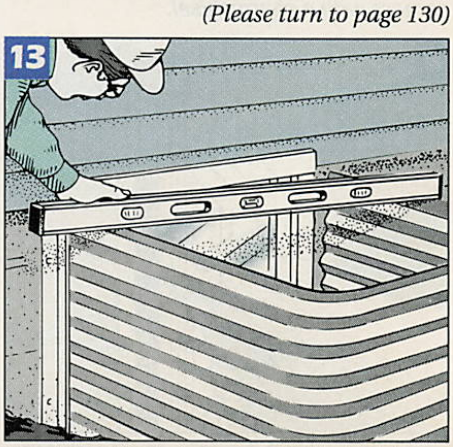
There's no getting around it: A concrete saw is an ugly, unwieldy tool that creates an enormous cloud of dust. So go at it slowly and wear full eye protection and a tight-fitting dust mask. While there's nothing particularly difficult about it, cutting and removing concrete is messy and can be intimidating. If you don't feel up to the work, hire a professional to do this part of the job, especially if you're dealing with poured concrete walls.

Make your first pass only about ¼ in. deep and concentrate on making a straight line. Once you've established a pathway for the saw blade, you can focus on cutting deeper (Fig. 1). With concrete block, a 1-in.-deep score is often adequate. For a solid concrete wall, try to finish with a cut at least 3 in. deep—ideally, the cut should extend halfway through the wall.

(Please turn to page 130)



Caulk all mating surfaces, including seams between window and trim, trim and siding, and trim and block wall.



Level the steel window well side to side and use backfilled soil to temporarily hold it against the basement wall.

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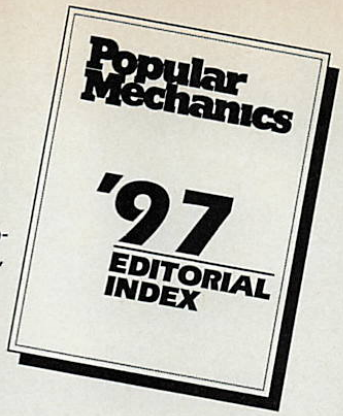

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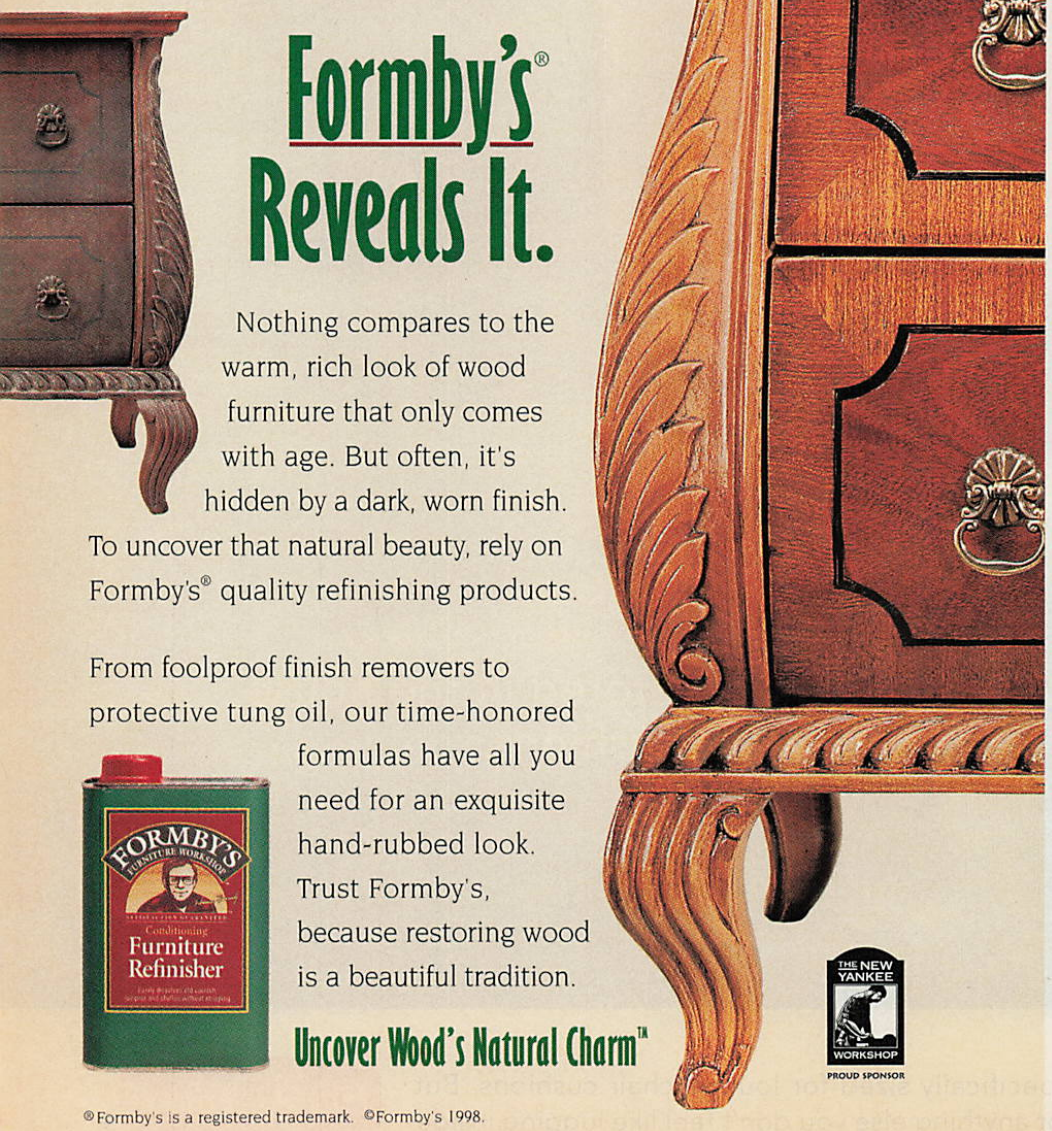

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When you've finished outside, make an identical cut inside (Fig. 2). Again, expect dust to be a problem. If you can't contain the dust with plastic sheathing, and the wall is concrete block, try scoring the inside block surface with a cold chisel. Then, tap lightly with a 3-pound hammer and hope for a clean break along the line. This method usually works, but is less certain than a clean cut with a concrete saw.

With the opening cut on both sides, start tapping the upper blocks with a hammer until they either break loose whole or crumble in pieces (Fig. 3). In our case, the old window couldn't be freed until the blocks were smashed.

Installing The Window

When you've removed all the blocks and chiseled away any obstructing mortar, build the pressure-treated box to fit the opening. Apply construction adhesive to those surfaces of the opening that will mate with the box. Press the box in place so that its outer edge is flush with the outside of the block wall (Fig. 4). Then, nail the top of the box to the sill plate and secure the side and bottom members to the wall with hardened concrete nails, or a powder-loaded driving tool, such as a Ramset, and 2½-in. nails. To avoid shattering the blocks' webbing, drive the nails into the mortar joints (Fig. 5).

We opted for a window without attached exterior molding because we needed extra-wide trim to cover the seam between the pressure-treated box and the basement wall. At the top of the window, the wider trim extends into the siding. For a job with wooden clapboard siding like ours, first measure and mark the siding for the inset trim at the top of the opening. Cut along the lines with a circular saw set for a ½-in.-deep cut and use a sharp chisel to complete the cuts in the corners (Fig. 6).

A typical untrimmed window has metal fins on each edge that act as nailing tabs for securing the window to the surrounding framework. To install the window, first fold the fins out. Then, set the window aside and apply a generous bead of caulk to

(Please turn to page 132)

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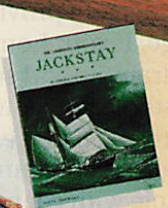

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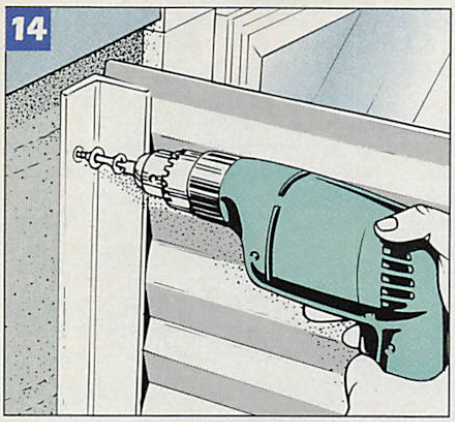
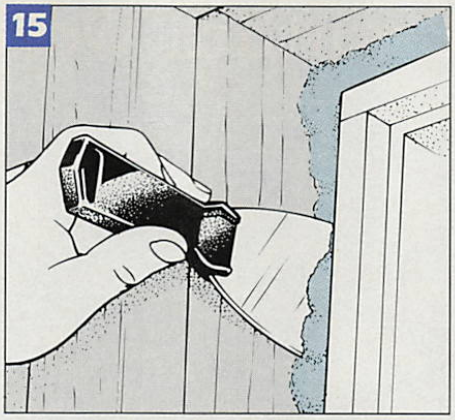
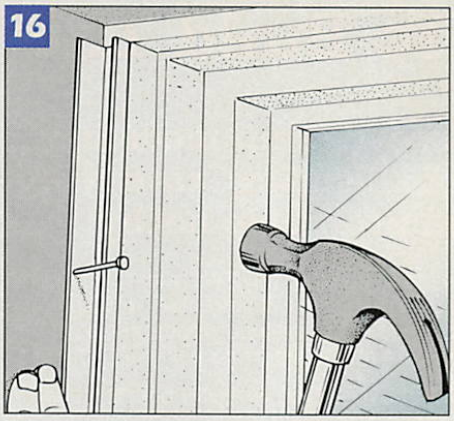


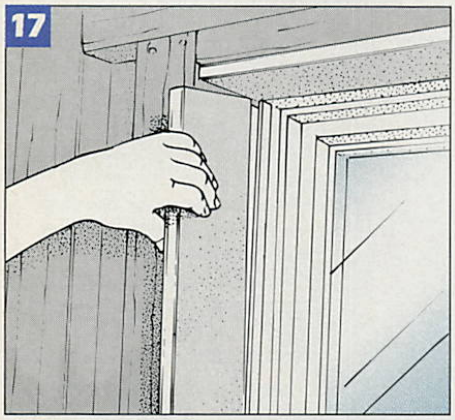
Use a masonry bit to bore holes into the concrete block at flange hole locations. Secure it well with Tapcon screws.



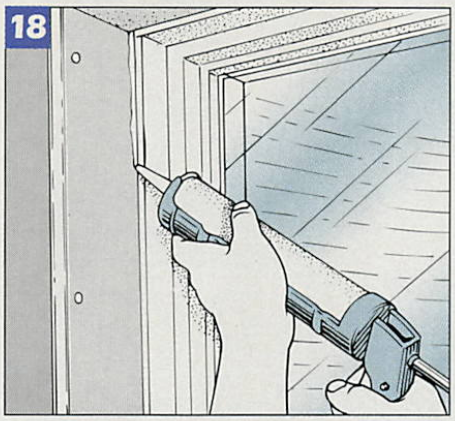
To insulate between the window box and window casing, pack the gap loosely with fiberglass insulation.



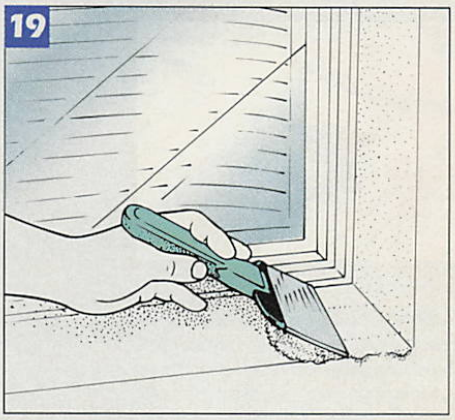
To extend the window jamb with drywall, nail J-bead to the box. Hold the bead 1/16 in. away from the jamb.



Slide strips of 1/2-in. drywall into the J-bead channel and fasten the other edge of the strips to the wall framing.



To maintain a thermal barrier, apply caulk in the 1/16-in. gap between the J-bead and the window jamb.



After installing drywall over the wall surfaces, add corner bead around the window opening and apply compound.

the box perimeter (Fig. 7). Place the window in the opening and have a helper on the inside center and level it while you drive galvanized nails through the mounting fins and into the surrounding box (Fig. 8). With the window nailed in place, mix a small amount of mortar and fill the gap between the wall and the box, and any cracks in the concrete that were caused by demolition (Fig. 9).

To finish the installation on the outside, cut the top trim to fit, press it into the siding recess and nail it in place (Fig. 10). Then measure and cut the trim for the sides and bottom of the window and nail these pieces in place (Fig. 11). Finally, caulk the seams between the trim and basement wall, between the trim and siding, and all around the window (Fig. 12). Then, prime and paint the trim.

Setting The Window Well

Level the ground in front of the window and lower the well into the hole. Level the well side to side (Fig. 13). Drill through the openings along the wall flange and drive Tapcon screws, backed with washers, into the holes in the block (Fig. 14). Backfill around the well, tamping the soil down in 6- to 8-in. steps. Finish by creating plenty of ground slope away from the well.

To handle excess water during a heavy rain, you'll need to provide adequate drainage. If your home's basement has a draintile and sump system, use a posthole digger to bore a hole near the wall that extends down to the gravel around the footing. Fill the hole with coarse gravel so that it can act as a spillway.

If no drainage system is in place, dig a 12-in.-deep trough along the back of the well and fill it with gravel.

To finish the bottom of the well, add about 3 in. of gravel to the floor to keep rain from splashing mud against the window.

Interior Finish

There are several ways of trimming out a basement window, including using wood extension jambs, but a drywall wrap is about as simple and inexpensive as it gets. Begin by framing the wall around the window. At the window, position the studs so the inside perimeter of the framed opening lines up with the outer perimeter of the window casing.

Then, insulate between the casing and the box (Fig. 15), and nail metal J-bead to the box on all four sides. Keep the metal bead about 1/16 in. away from the wooden casing (Fig. 16). If necessary, add cardboard shims between the J-bead and box to bring the bead in line with the outside of the window casing.

With the J-bead nailed in place, slide strips of 1/2-in. drywall into the bead channel and nail or screw the strips to the framed opening (Fig. 17). Caulk the 1/16-in. gap between the metal bead and the casing (Fig. 18). Then, drywall the room and install corner bead where the opening meets the wall. Finally, finish with drywall joint compound (Fig. 19), and paint the jamb extensions with semigloss paint. PM

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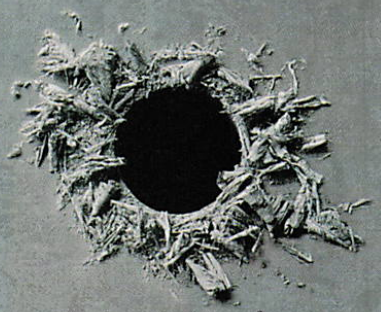

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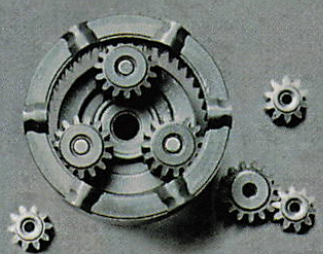

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Homeowners Clinic

BY NORMAN BECKER, P.E.
Illustrations by George Retseck

Stair Design

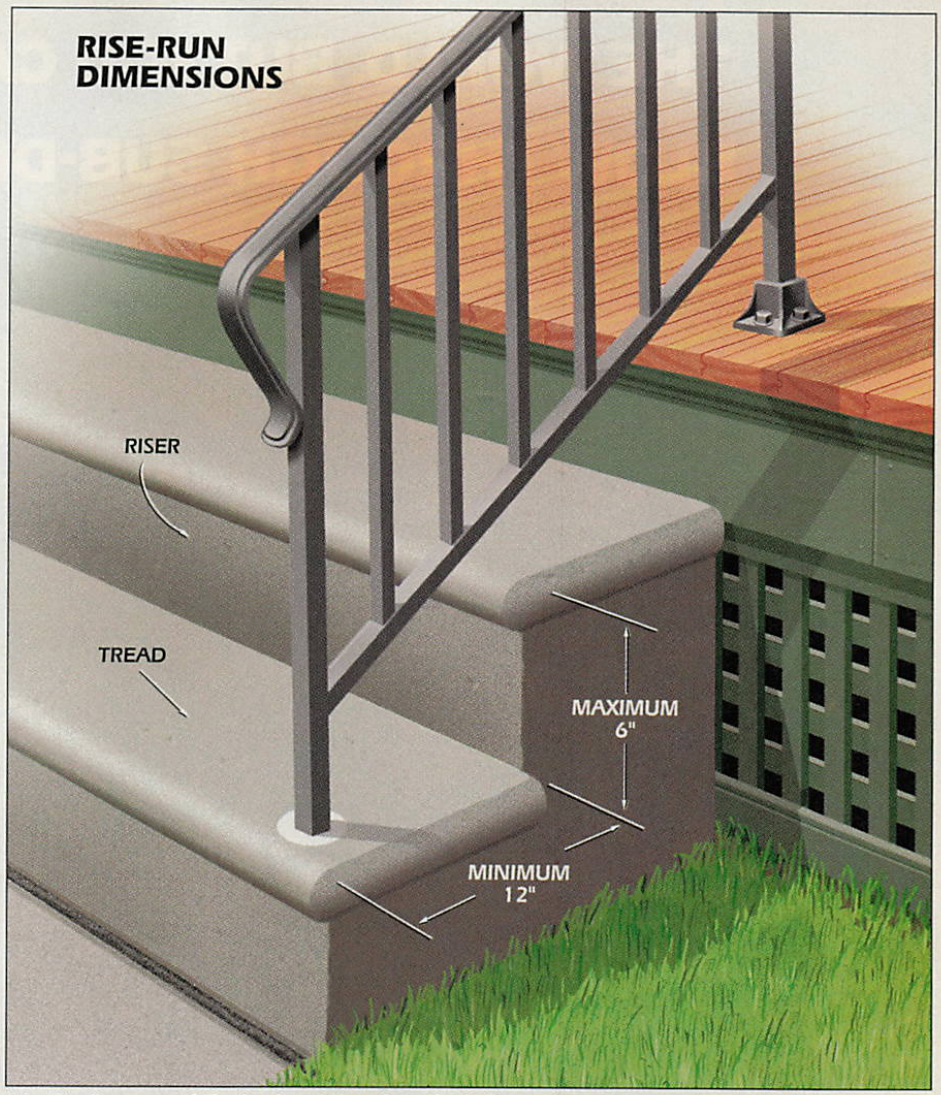
What is the ideal run and rise for porch steps and front door steps? What dimensions make for a safe and functional stair?

LYMAN REHMEIER
JELM, WY

There is no single ideal rise and run. There is, however, an ideal sum of the rise and run. That is, one rise plus one run should add up to 17 to 18 in. Various state and national building codes give a range for both rise and run, but some don't differentiate between interior and exterior stairs. In order to provide you with an answer that is based on engineering and human-factor analysis, I bypassed the various building codes and went to a book published by the U.S. Department of Housing and Urban Development, A Design Guide for Home Safety. *The book gives five parameters for interior and exterior stairs. This is based on the fact that exterior stair construction is not always limited by the space restriction placed on interior stairs. Also, exterior stairs are generally used more often by persons carrying bulky or heavy items. The design parameters for both interior and exterior stairs for residential applications are listed below. For readers unfamiliar with this terminology, the tread is the horizontal part, from its front edge to its back corner. The run is the tread's dimension minus the width of the "nosing," or the projection at the step's edge.*

Interior stairs—
Maximum riser height: 7½ in.
Minimum run width: 10 in.
Minimum tread width: 11¼ in.
Maximum nosing: 1¼ in.
Exterior stairs—
Maximum riser height: 6 in.
Minimum run width: 11 in.
Minimum tread width: 12 in.
Maximum nosing: 1 in.

A variation in the riser height of steps in a staircase will interrupt the natural rhythm of the person using the steps and could cause him or her to trip and fall. HUD recommends that variation in riser height and tread width in a flight of stairs should not exceed 3/16 in.



Ideally, the sum of the horizontal and vertical dimensions for an outdoor stair add up to a number between 17 and 18 in. Also, handrails should be installed on outdoor stairs.

Sealing In Urine Odors From A Concrete Floor

The previous owner of our 2½-year-old home kept two dogs in the basement. The dogs urinated on the basement's concrete floor, and we have found it impossible to clean the concrete enough so the stains are removed and the odor is gone. How can I clean up this mess?

LARRY COSTANZO
ORLAND HILLS, IL

A white-pigmented coating called Kilz might be the solution. The manufacturer says the coating is formulated to block out urine odors from concrete. However, for it to work, the area below the floor must be dry—water or moisture vapor should not seep through the basement's concrete slab.

To determine whether or not moisture is seeping through the concrete, take an 8-in. × 8-in. square of aluminum foil and lay it flat on the concrete. Tape it on all sides. Leave it for 48 hours, and then carefully remove it. If the underside of the foil is damp or wet, you must take whatever measures are necessary to eliminate the condition, such as regrading around the foundation and redirecting downspouts. In extreme cases, foundation drains need to be installed.

Kilz is sold by the gallon in hardware stores, paint stores and home centers. One gallon covers approximately 300 to 400 sq. ft. and costs about $15. For more information, contact Masterchem Industries Inc., 3135 Highway M, Barnhart, MO 63012.

(Please turn to page 136)

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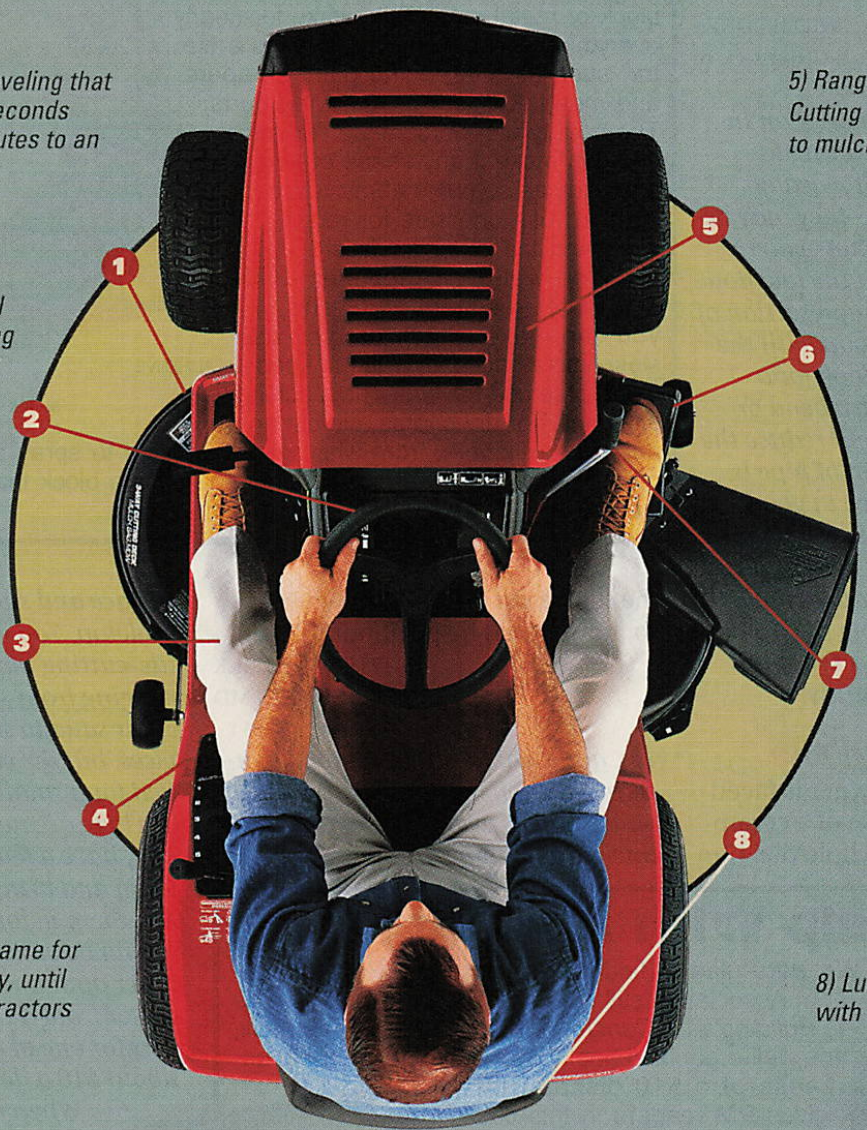

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Varying Hot-Water Pressure

The hot water in my kitchen faucet and a basement faucet are flowing slowly, but the flow in a second-floor bathroom is strong. What could be the problem?

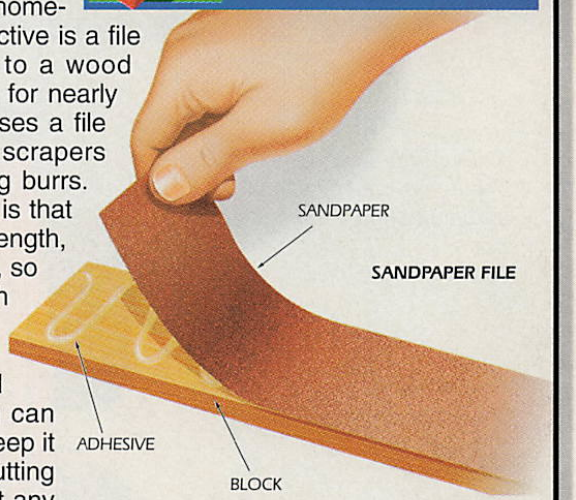
WILLIE JONES
CHICAGO, IL

There is evidently a constriction in the water supply line leading to those sinks. Check the hot-water valves under the sinks—they may be closed. Try to trace the hot-water supply to the sinks with the low flow. They may share a common section of pipe that is not in the loop with the other sinks. If they do, look for a partly closed valve, sharp bend or kink in the pipe. This will reduce the water flow. If the section of pipe is iron, it may appear to be in good condition on the outside, yet have a buildup of mineral deposits and rust on the inside, which reduces flow. If none of these are causing the problem, then I would suspect that the hot-water faucets are faulty.

File It Away

SERVICE TIP: MAINTENANCE

Small metalworking jobs around the house should not go without attention because you don't own a file. A homemade tool that we've found effective is a file made from sandpaper glued to a wood block or metal strip. This works for nearly everything that a homeowner uses a file for, such as sharpening paint scrapers and mower blades, or removing burrs. The beauty of a homemade file is that you can make it any shape or length, and you can combine abrasives, so you can use one side for rough work and the other for finishing. Use wet-dry sandpaper and water-resistant glue, and you can make a tool that you can slosh into a bucket of water to keep it clean or to use the water as a cutting lubricant. For dry chores, almost any adhesive will work, from white or yellow glue to spray adhesives. The same process also makes a nice multigrit sharpening block that you can clamp to a workbench.



—Roy Berendsohn

Cutting Ceramic Tile

Occasionally a homeowner is faced with replacing a portion of a ceramic tile rather than the whole tile. Can the tile be cut by a homeowner? If so, how would he go about it?

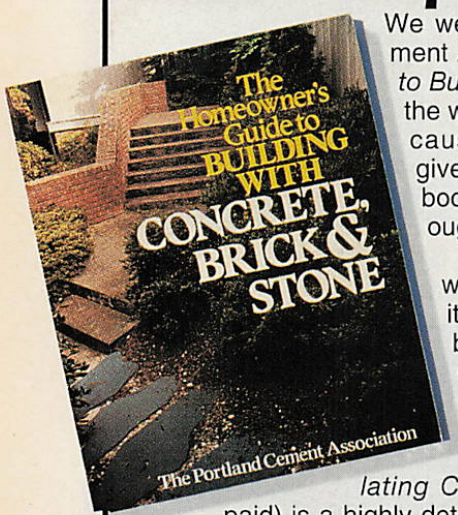
MATTHEW J. JURICK
SILVER SPRING, MD

Yes, a tile can be cut by a homeowner, but the job requires a special tool. Since a tile is usually 5/16 in. to 3/8 in. thick, you cannot simply score the surface and snap it at the edge of a tabletop. You can buy a variety of tile-cutting tools at a home center, ranging from small wet-cutting circular saws to score-and-snap devices, but the cost may not be justified for a small job.

There are two approaches. If you only have a few tiles to cut, mark them and bring them to a tile store. Ask them if, for a few dollars, they would be willing to cut the tiles. The other option would be to rent a tile cutter from a tile store. The rental cost for one of these machines is only about $10 a day.

When removing the tile to be replaced, you should be careful not to damage the adjacent tiles. First, use a grout saw to remove the grout around the tile. This is not a mechanical saw, but a simple abrasive tool that you run along the grout lines. After the grout is removed, use a cold chisel and carefully chip away the old tile. Begin the process by chipping away the tile's center, then work to its edge. Wear safety glasses when doing this work. **PM**

Review: Help With Masonry



We were glad to find recently that the Portland Cement Association still offers the *Homeowner's Guide to Building with Concrete, Brick & Stone*. Better still, the well-organized book costs only $10 postpaid because of a $10 discount the PCA gives PM readers in this case. The book covers its three topics as thoroughly as a homeowner will need.

While we were on the phone with the association, we learned it has introduced both a book on building with insulated concrete forms (known as ICF construction), and a 5-part video series on the topic. The 326-page book, *Insulating Concrete Forms*, ($60 postpaid) is a highly detailed look at these systems, from design through installation to completion. Numerous section and perspective views of various ICFs are given. If you're considering building with an ICF system, the book is necessary reading. The video series ($65 postpaid) doesn't provide detailed information, but it gives a realistic overview of ICFs, since much of its 80 minutes was filmed at construction sites. The five videos are design, planning, setting forms, placing concrete and utilities/interior finish. Contact the Portland Cement Association, 5420 Old Orchard Rd., Skokie, IL 60077. *—R.B.*

PHOTOS BY ROSARIO CAPOTOSTO

DO YOU HAVE A HOME-MAINTENANCE OR REPAIR PROBLEM?

Just ask Norman about it. Send your question to Homeowners Clinic, Popular Mechanics, 224 W. 57th St., New York, NY 10019. While letters cannot be answered individually, problems of general interest will be discussed in the column.

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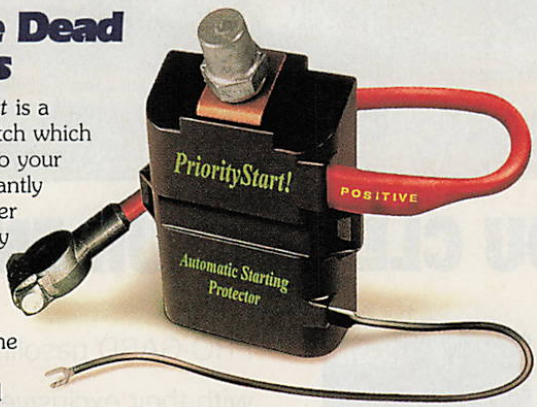

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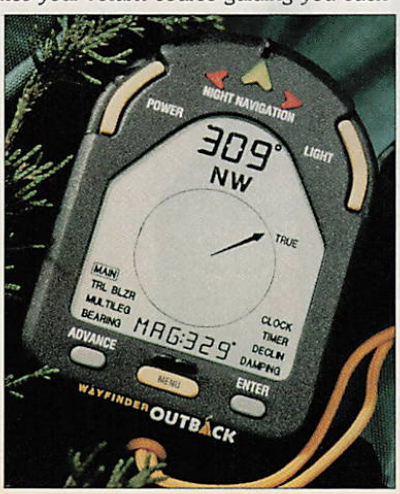

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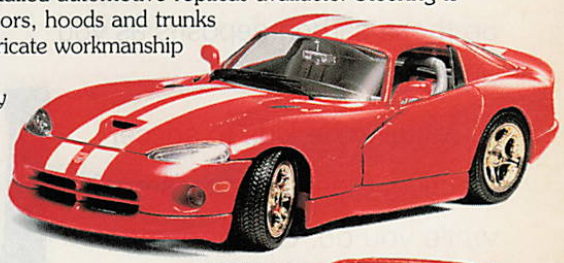

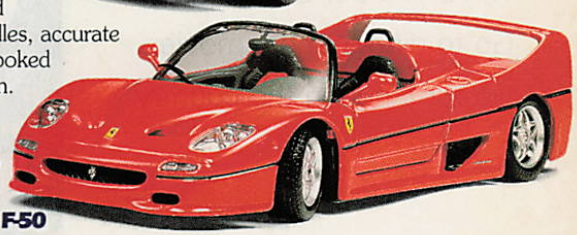

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Automotive Car Care

Auto Clinic

BY MIKE ALLEN

Uncovered

I needed to remove one tie rod end from my pickup to work on the axle, so I borrowed a tie rod end removal tool from a mechanic friend. It damaged the boot while popping the rod end off, although the joint itself is fine. The problem is, I can't find a replacement boot anywhere. Where can I find one of these rubber boots?

ACE TAMARAEU
CORPUS CHRISTI, TX

You probably can't. At least not without buying an entire rod end. Best bet would be to try a salvage yard for a used boot. Generally, you can just remove the small wire clamp and put the thing back together. Flush the joint with grease before you put the boot on by pumping grease through the Zerk fitting until fresh grease comes through. Wipe off the old grease and repeat before putting the boot on. Then add grease again until the boot is full but not turgid.

No Zerk fitting? Then you may as well bite the bullet and buy a new rod end that has one.

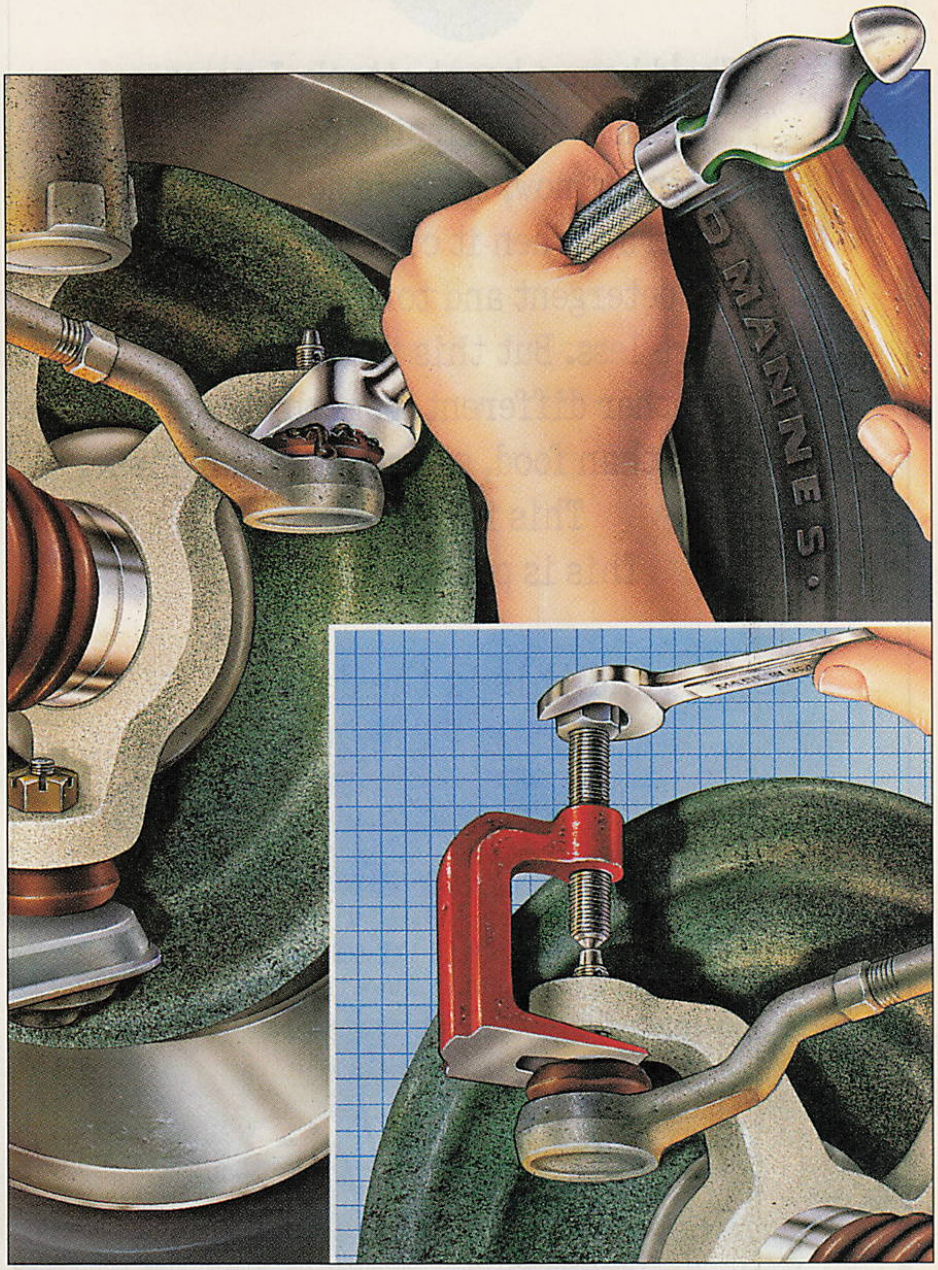

ILLUSTRATION BY DON MANNES

Put A Tiger In Your Tank

Which octane is best for your car, 87, 89, or 92? The manual for my car specifies 87 octane, which I've been using for 20,000 miles. A friend of mine was there one day as I was gassing my car and asked why I wasn't using 92, as it was a cleaner fuel and better for my car. He said the Corvette uses the same engine as my '96 Impala SS, so I should use the same fuel, which would be the 92 octane specified for the Vette.

MICKEY PERMAN
VIA INTERNET

If your car runs without ping on 87, use 87. The Corvette engine is in a higher state of tune than the 350 in the SS, and needs more octane. There is no advantage to using the more expensive fuel once you get the octane up to where it belongs. In fact, higher-octane gasoline has slightly less heat (energy) content, and might actually reduce your mileage.

How do you know how much is enough? Many modern cars have knock-detection systems built into the engine computer, and will crank back the ignition timing to eliminate knock, at the expense of engine efficiency. A mechanic's scan tool used during a road test can tell you if the ignition timing is being retarded. Keep upping the octane until the ignition timing is normal.

He Worked It Out With A Pencil

I wrote to you a while back about the poor heat in my pickup. I tried all the obvious things—had the thermostat replaced, flushed the system and the heater core, checked the cables to the heater plenum and blend air doors, etc. Finally, I bit the bullet and disassembled the heater plenum behind the glovebox. Hey! What's this pencil doing in here? I don't think Ford installed it. It was holding

"My mom would freak!"

"She'd have a heart attack, I swear.
Her only son clipping coupons.
Mr. 'spend it now, there is no tomorrow.'
Well it's true. When it comes to apple sauce, laundry detergent and toilet paper I could care less. But this is something altogether different. Something more important than food, girls and good hygiene.
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the blend air door open enough to let in cold air, even though the dash selector was in the HOT position.

GEORGE KRICKOVICH
VIA INTERNET

Sometimes it seems the obvious thing is obvious, sometimes not. The previous owner must have dropped that pencil down the duct. I've found all manner of objects, mouse nests and other weird stuff inside heater plenums over the years. Sometimes they're not a problem, sometimes they are. If you ever drop anything down the dashtop vents, listen and watch carefully for reduced heater/air-conditioner performance, buzzes, or smoke from the stalled blower fan. Sometimes you can reach the object through the hose connection (easy), sometimes you have to disassemble the plenum (hard or very hard).

Noise Is Un-Bearable

I have a 1988 BMW 735i with 206,000 miles on it. The transmission was rebuilt and the driveshaft was worked on recently. I can hear a noise when decelerating, which my mechanic has diagnosed as differential bearing failure. With the advances in lubricants they are making nowadays, is there any additive I can use to minimize the noise?

B. HOWING
FREMONT, CA

No. The bearing has already spalled, which is why it's making noise. No mouse-milk additive can fix that, nor can it remove the particles of bearing race and roller from the lube in your differential housing. Those wear particles are rapidly grinding away at your other bearings and ring and pinion gear. Your only cure at this point is a total differential rebuild. And at 200,000 miles, it's overdue.

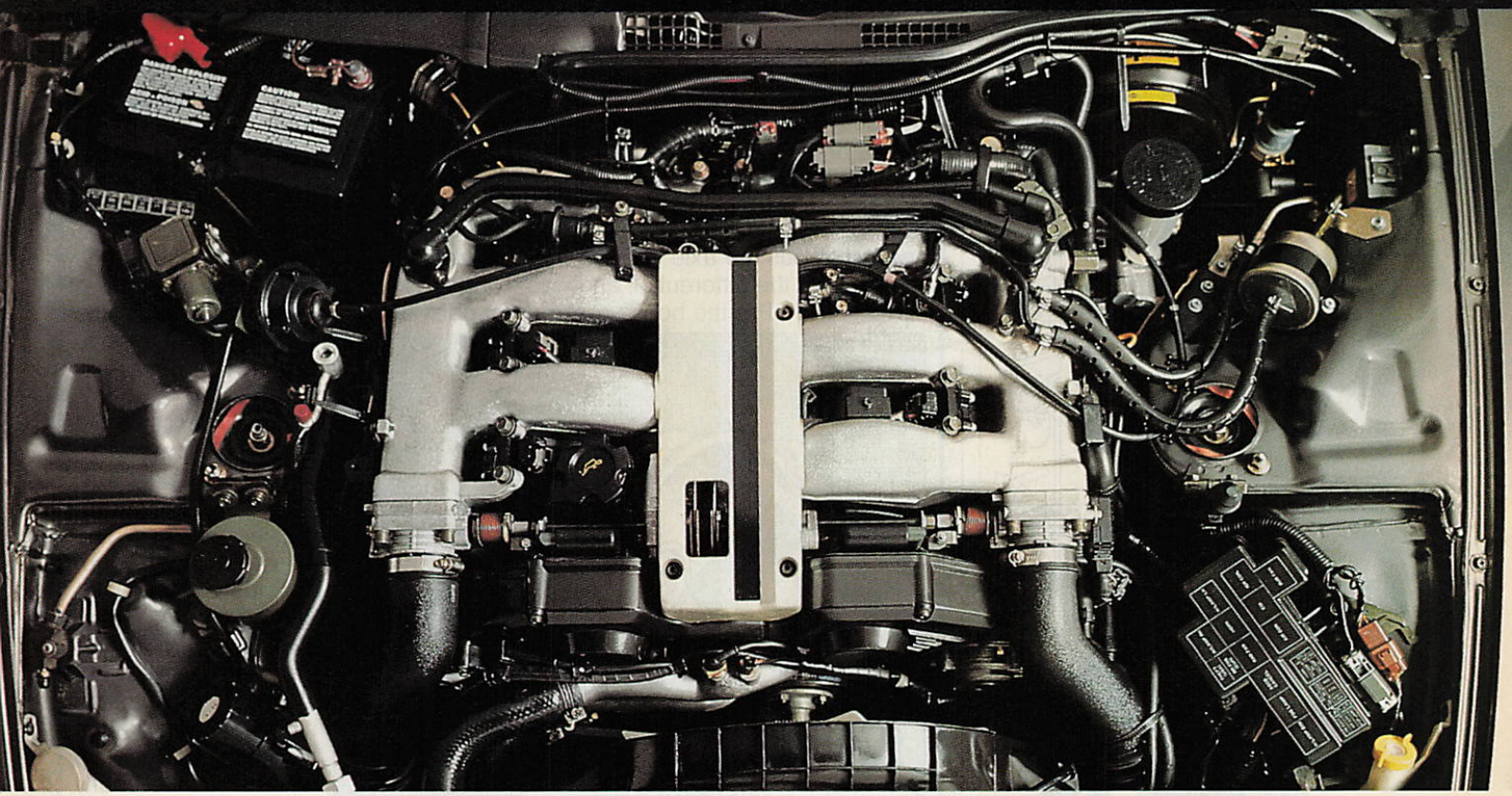
We're Jammin'

I'd like your professional opinion on radar jammers. I'd like to purchase one, but do you know if they actually work? Also, do they work on photo radar and laser? I also heard the bras on a car will defeat radar.

JEFF ZOLINSKI
VIA INTERNET

(Please turn to page 144)

New Technologies.



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Car Care

CAR CARE TIP

For Whom The Bell Tolls

One of my neighbors wandered over last Saturday, asking to borrow a brake drum puller. But he'd rung the wrong bell, for two reasons: I generally don't lend tools, and I don't even have a brake drum puller. Nevertheless, I strolled over to see if I could help. Actually, he already had the brake drum loose, and needed to pull the axle shaft to replace the bearings. He already had the C-clip loose at the differential, and was trying to pull the axle loose. So I showed him this trick: Put the heavy brake drum back on over the wheel studs inside out, thread on three to four lug nuts a few turns, and use the brake drum like a big slide hammer to knock the axle out. And wear earplugs, because it's loud. The axle will only pop out a small amount with every hammer stroke at first, but will move more easily within ¼ in. or so. Be careful not to get smacked in the mouth or kneecap when the axle finally pops loose.

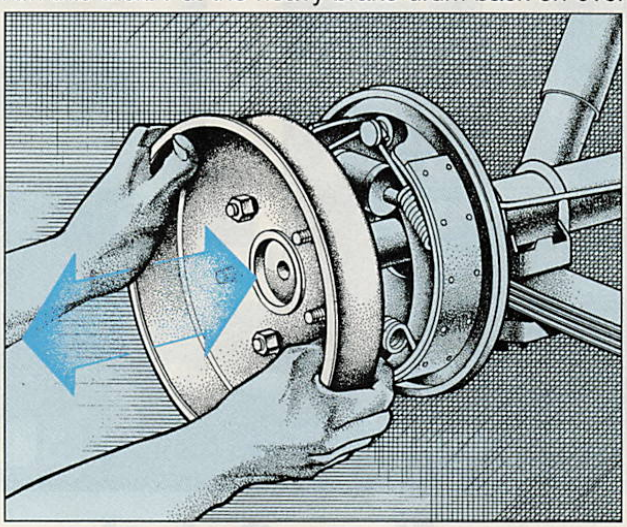


ILLUSTRATION BY ADOLPH E. BROTMAN

Save your money, Jeff. Is it possible to build a true, effective radar jammer? Yes. Is it legal? No. Aside from the fact that operating a radar jammer is illegal on a local or state level because its only purpose is to defeat legitimate law enforcement radar, it's against Federal law. At least that's the way I read the Communications Act of 1934. Any active radar transmitter in your car that was strong enough to jam police radar would need to be licensed by the FCC—and don't hold your breath on that one.

What about passive devices, the kind that are supposed to trap radar waves, scramble them and return them to the radar gun? Unless they are large enough to represent a substantial portion of your car or truck's frontal lid—say, as big as a trash can lid—their return signal won't be strong enough to overpower the signal that bounces back from your car unscrambled. Same goes for photo radar, which simply has an added camera to provide documentation of the speeder for the court. I don't know of any way to jam laser speed detection, except to paint your entire car, including the windshield, flat black. A vinyl fabric bra will have no effect on radar signals unless it's lined with microwave-absorbing compounds like they use on the stealth bomber. PM

SERVICE TIPS

- Does your 1994-97 Jeep Grand Cherokee/Wagoneer creak? It may need a transfer case shifter repair kit (PN 04886481AA). Technical Service Bulletin (TSB) No. 21-02-97, Revision A.
- Caddy makes condenser seals and a new orifice tube to boost a/c cooling in 1994-96 4.6L/4.9L models. TSB No. 63-12-05A.
- Storing a Lexus? It's advisable to periodically start up the a/c *at low rpm only* to circulate the refrigerant oil. TSB No. AC003-96.
- Porsche lowered the torques on the oil drain plugs to 37 ft.-lb. on certain 911s back to 1989. Make a note of this for yourself or your mechanic. TSB No. 9409.
- If your 1995-96 Toyota Tacoma or '96 4Runner buzzes after engine shutoff, a dealer will install an air chamber on the EVAP canister under warranty. TSB No. EG002-97.

DO YOU HAVE A CAR PROBLEM?

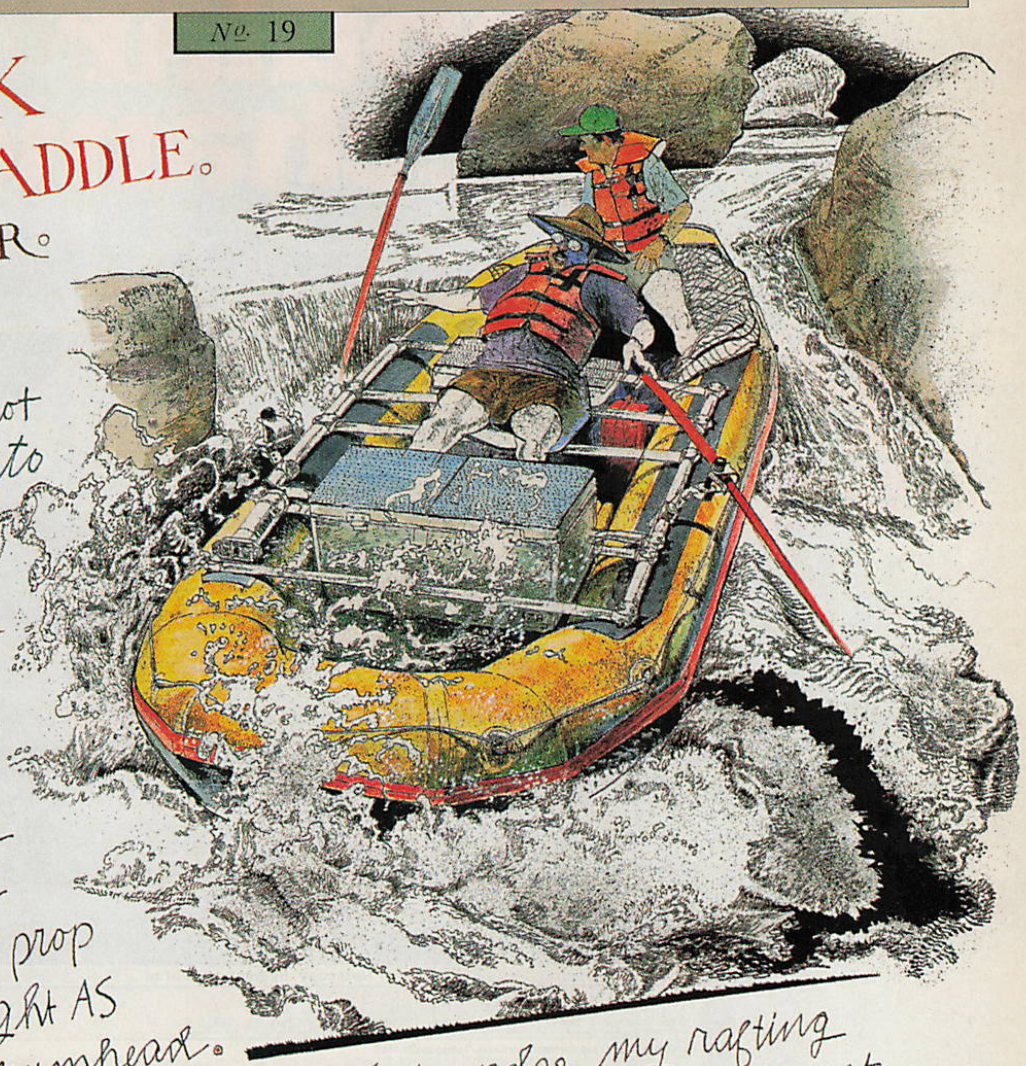
Just ask Mike about it. Mail your question to Car Clinic, Popular Mechanics, 224 W. 57th St., New York, NY 10019. While letters, faxes or phone calls cannot be answered individually, problems of general interest will be discussed in the column.

TOOL TALES

[REAL STORIES OF *LEATHERMAN® TOOLS* AND THE PEOPLE WHO USE THEM.]

No. 19

UP A CREEK WITHOUT A PADDLE. OR A MOTOR.



I lost an oar as our white water raft shot out the rapids and into the mouth of the Owyhee River, A wind swept, 10-mile long reservoir. As I started our small gas motor, A stray rope wound itself around the prop tight AS A drumhead.

I tried, and failed, to wedge my rafting knife into the tangled mass. THEN I remembered my ever-present LEATHERMAN MICRA. Its scissors bit through that rope like A chain saw through butter. After my experience I'd say that "good things come in small packages" is A BIG understatement.

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Automotive

Car Care

Tuneup For The '90s

BY PAUL WEISSLER

As you pull into the gas station to fill the tank, you realize that your surroundings seem very familiar. That's because you just filled the tank three days ago.

SATURDAY MECHANIC

But since you've driven nowhere special—just the regular runs to work and the Chili Trough for lunch—it seems that you shouldn't need gas yet. Now that you think about it, your car seems to have lost a bit of zip along with those mpg's. Can it be due for a tuneup? But what about those extended tuneup periods you keep hearing about for modern cars? What's going on here?

What's going on is that all of that hype about 100,000-mile tuneup intervals makes good advertising—but it isn't actually what's best for your car. An annual underhood tuneup-type inspection still should be performed. You'll find a number of parts that require cleaning, adjustment or replacement. And even if they seem to have some useful life left, you should routinely replace some tuneup parts every other year.

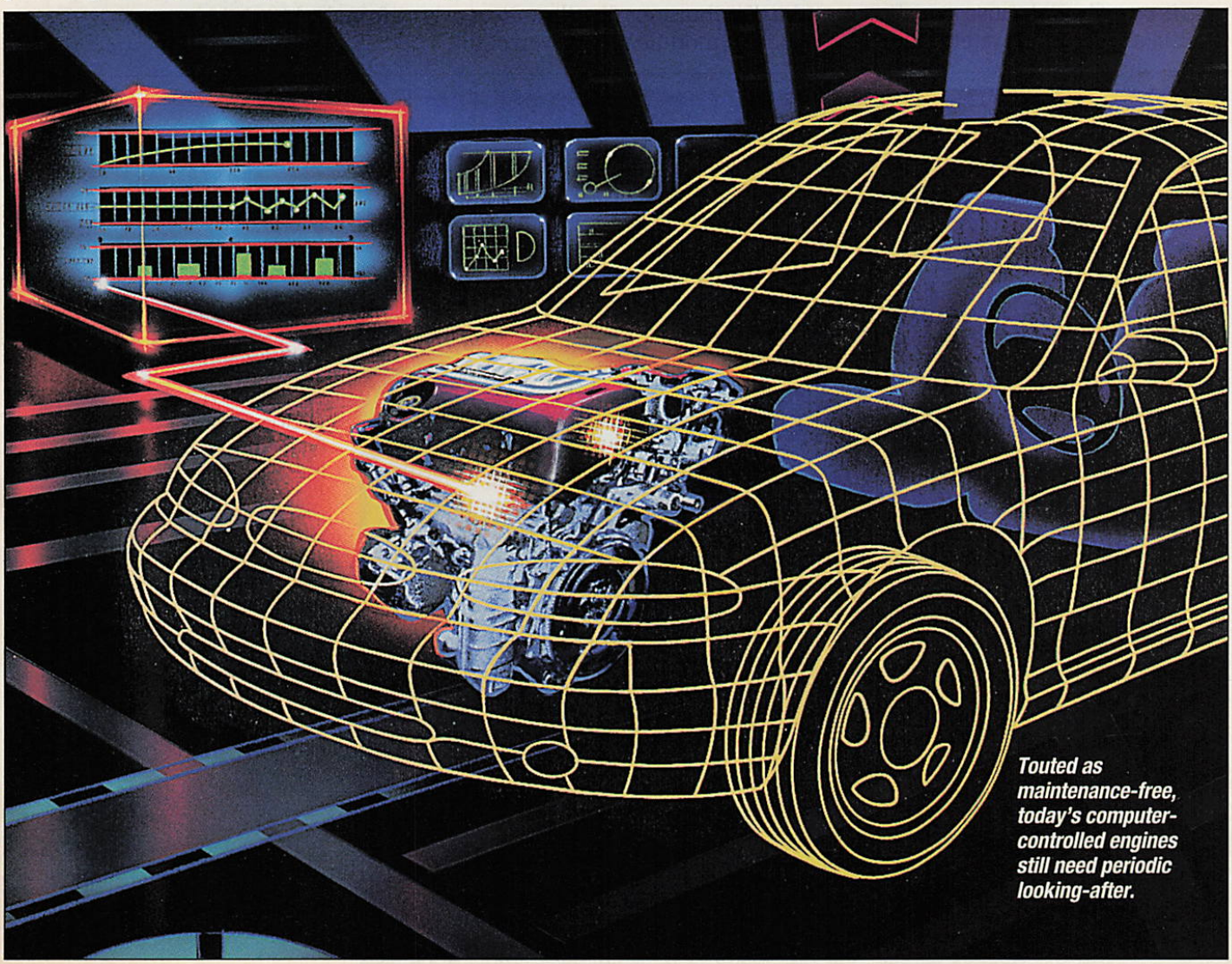
Degree of Difficulty

MODERATE

Trouble In The Codes

On your dashboard is a Check Engine light (now called a Malfunctioning Indicator Lamp), and when it goes on, the powertrain computer has logged a trouble code. However, you can't rely on the light to tell you whether or not to look for a code. Many 1980s cars did not even have a light on the dash. Even if a car has a dashboard light, many problems don't turn it on, even though the computer stores a code in its memory.

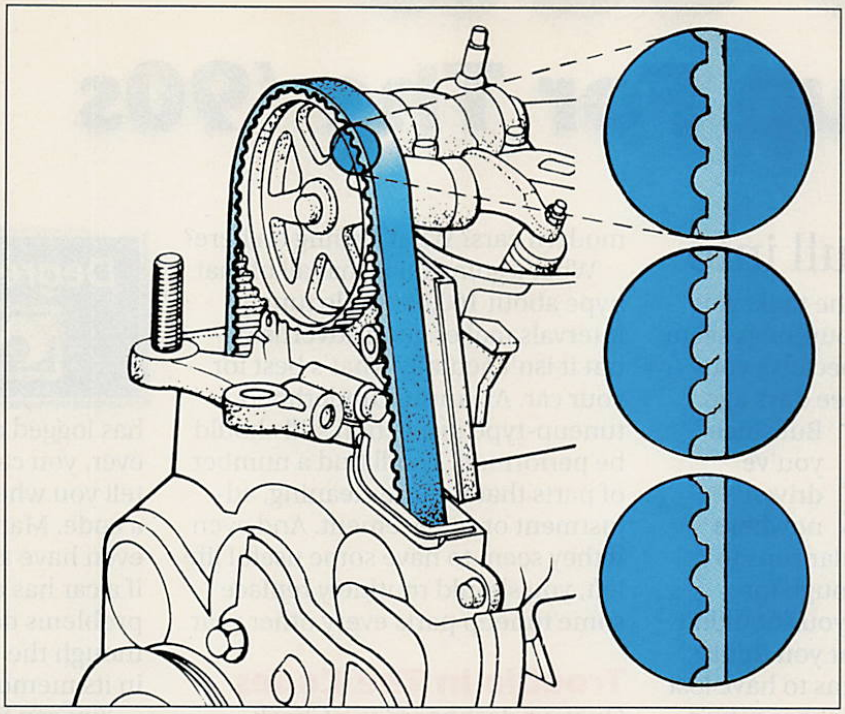
You can find out how to get almost all trouble codes from a factory service manual for your specific car—not just one for a recent model—or a



Touted as maintenance-free, today's computer-controlled engines still need periodic looking-after.

ILLUSTRATION BY DON WIELAND

suitable aftermarket manual (not just the basic one-size-fits-all type). Read the manual carefully to learn how to trace a trouble code signal to find out what's wrong, and follow the "tuneup" inspections and maintenance steps we're covering. You'll avoid most problems and find and fix most of the others.



Check your timing belt for wear and cracking at least once per year.

ILLUSTRATION BY RON CARBONI

Still Sparking

Remove the spark plugs and, if the idle is rough, take a compression test. Unless you have platinum-tip plugs, replace the plugs every two years or 24,000 to 30,000 miles. Disconnect plug wires by the nipples only, or you could cause the wires to separate internally and cause a misfire. Disable the ignition system prior to doing a compression test by unplugging the low-voltage connector at the distributor or distributorless ignition module, before you crank the engine. If, as a result, the computer logs a trouble code for an ignition primary circuit problem, erase it by disconnecting the battery ground cable for a minute. However, this erases some fuel system calibrations, and it can take up to 100 miles or several hours of driving for the powertrain computer to "relearn" them, so driveability will be so-so until then.

Inspect the plugs for wet-black deposits from oil burning (usually indicative of bad valve stem seals) or dry-black (typically fuel deposits from leaking injectors or a bad oxy-

(Please turn to page 150)

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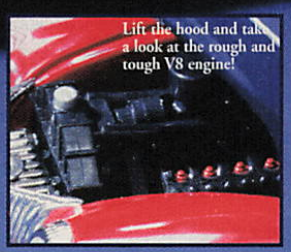

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Car Care

(Continued from page 148)

gen sensor). Check the plug gaps for wear, and if the plugs are worn .010 in. over specs, replace them.

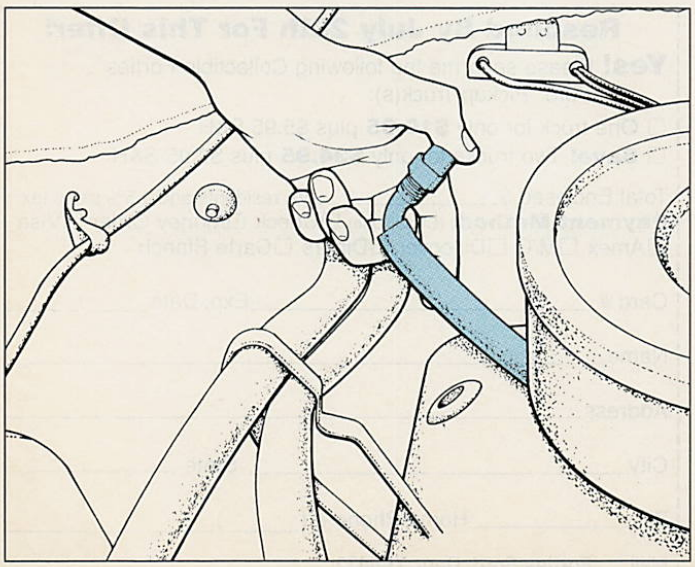
Test the plug wires with an ohmmeter at each terminal, and compare the readings with specifications. About 15,000 ohms per foot of length is typical, but unless you find exterior insulation damage, check factory manual specs, as some wires run several times that number. Duplicate the original routing of the wire using the clips on plastic guides.

Though the engine computer controls ignition timing, you may have to check the initial (base) timing, following a specific service manual procedure.

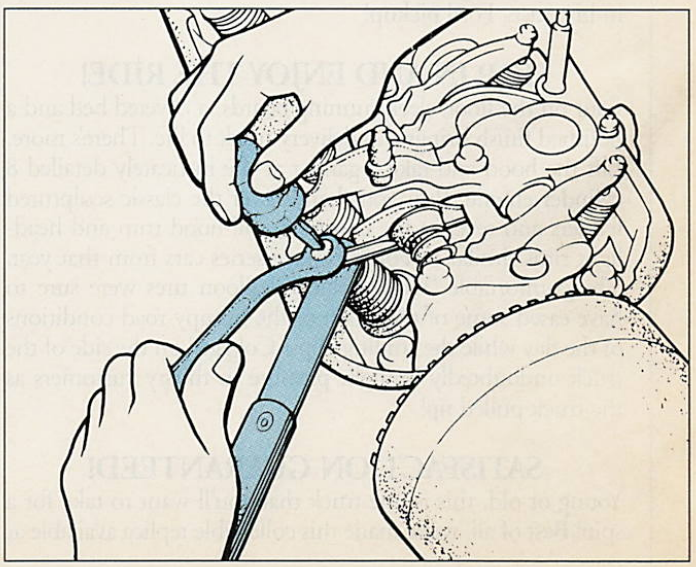
Quit Fuelin' Around

Listen to the fuel injectors as the engine idles. Either use a mechanic's stethoscope or hold one end of a short piece of heater hose on the injector body, with the other end of the hose to your ear. You should hear a steady sewing-machine-like sound.

(Please turn to page 152)



The PCV valve should suck the end of your finger with the engine running at idle. Check for a clogged valve, and replace if necessary.



There are still a few vehicles in production that use mechanically adjusted valves, rather than hydraulic adjusters.

ILLUSTRATIONS BY RON CARBONI

Advertisement

Breakthrough: Answer To Arthritis Pain Discovered

by Dr. Larry Doss

While more than 18 million Americans are suffering from agonizing pain due to arthritis, a team of researchers have come up with an astounding breakthrough that can actually eliminate chronic pain, joint stiffness, lack of mobility, and inflammation.

The exciting news comes at a time when one out of every seven Americans is suffering from some form of arthritis—either rheumatoid or osteoarthritis. However, thanks to scientific researchers, there is hope for those with the disease, and preventive measures that others can take.

The research team's results—as well as a description of the all-natural nutrients that can prevent arthritis and alleviate the terrible pain that goes with it—are detailed in a just-released report that is the most authoritative and revealing ever published about the disease.

The report, written by a trio of doctors in easy-to-understand English, cuts through the traditional gloom and doom that most arthritis sufferers have heard for years. It details how both those with rheumatoid arthritis and osteoarthritis were able to overcome the disease.

That's because these doctors made a startling discovery as to the cause of arthritis. Primarily, arthritis develops because of a shortage of a specific nutrient—called an *enzyme*. The researchers found that as we age, we produce less enzymes. In fact, by the time we hit 60, our production of *enzyme* diminishes by 50%. That is, a 60-year-old has 50% *fewer enzymes* than a 30-year-old! Thus, if those with arthritis (or those wanting to prevent it) take an enzyme *supplement*, they can replenish their enzyme supply—reduce and even eliminate their pain and inflammation.

Further more, this enzyme supplement doesn't just reduce the *symptoms* of arthritis — it goes right to the *root* of this crippling disease and halts its progression and even reverses it. And, unlike traditional treatments that cause serious side effects—enzyme supplements have *no* negative side effects.

In the report, there are countless examples of how enzymes helped arthritis patients. In one, for example, out of 1,004—*76% to 96% showed significant improvement in their symptoms*. The enzymes reduced their pain, stiffness, joint swelling, ability to bend, and slowed down or completely halted their joint deterioration.

Thanks to this breakthrough, arthritis sufferers can now live a full and active life!

In the report, which is called *The Fountain Of Life*, researchers also detail how these incredible nutrients can do everything from healing bruises and injuries, to treating and preventing dozens of other diseases.

This special report is available for only $14.95 (plus $3 for postage and handling). To order, send your name and address with payment to Health Quest Publications, P.O. Box 34007, Dept. 1804, Fullerton, CA 92834-9407. You may return the book within 90 days for a full refund if you're not completely satisfied.

Advertisement

Doctor Eliminates Prostate Problems

by Lawrence Taylor M.D.

If you have prostate problems–that is, you get up three or four times a night to urinate, or you frequently "dribble" after urination, or you have pain with urination or painless bleeding or even pain during or after sex–there is an important new in-depth study, *The Doctor's Prostate Report*, that could mean the difference between life and death.

The Doctor's Prostate Report is a remarkable, highly informative work written by the leading prostate specialist in the country, Dr. James Balch. In language that anyone can understand, Balch explains–in detail–everything from why prostate problems (and cancer) develop to how you can prevent these dreaded ailments.

The Doctor's Prostate Report shows you how to get relief from distressing and often painful prostate symptoms–without surgery or pharmaceutical drugs that frequently have disastrous side effects. It describes a simple nutritional combination, used safely in Europe for more than 40 years, that can actually shrink a swollen prostate and protect your sexual potency.

This book comes at just the right time since researchers project that one out of every two men are going to have prostate problems (if they don't already). Dr. Balch also explains that there are three different prostate problems: an inflammatory condition of the prostate called prostatitis; BPH, the age-related swelling of the prostate that leads to frequent urination; and prostate cancer.

If not handled, prostate disease can do everything from causing intense pain and hindering sexual intercourse to causing infertility. Death from the last stages of prostate cancer is man's most-painful experience. *The Doctor's Prostate Report* is loaded with protective, safe and all-natural strategies that will help anyone alleviate prostate problems and protect against prostate cancer.

Interestingly, the prostate causes some of the major health problems for American men. Each year 400,000 of them spend over three billion dollars on prostate surgery, and as a result, half of them never have an erection again. The book also reveals that the widely prescribed drug, Proscar, which supposedly shrinks an enlarged prostate, does not work on half of those taking it. Equally disturbing, impotence often becomes a side effect.

The Doctor's Prostate Report is an important, practical book for all men–whether they have prostate problems or not. It is available for only $14.95 (plus $3 for postage and handling). To order, send your name and address with payment to *Health Quest Publications*, P.O. Box 34007, Dept. 1807, Fullerton, CA 92834-9407. You may return the book-within 90 days for a refund if not completely satisfied.

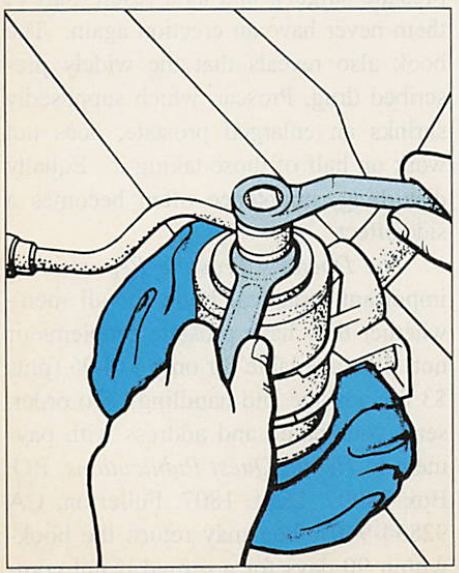
If an injector has a muffled sound, it may be sticking. Add fuel-injector cleaner to your gas.

Loosen the gas cap. If you don't hear a whoosh, the cap isn't holding pressure, either because it's defective or there's a bad vapor line connection somewhere. In any case, inspect the hose connections at the canister and trace the hoses to the other ends. Replace deteriorated hoses with ones specified for fuel resistance.

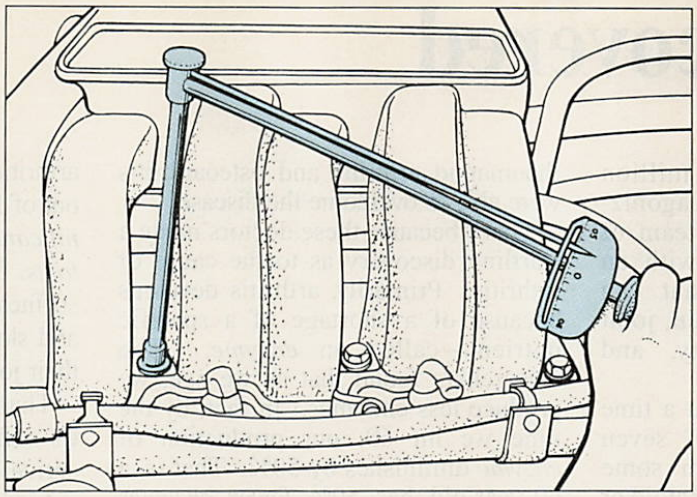
Check idle speed when the engine is warm. If it's off spec, it may be adjustable (on engines with carburetors, of which there are still tens of millions). Incorrect idle speed on fuel injection could be caused by a defective sensor or a leaking injector air seal.

Check other air seals, too. Inspect the flexible duct between the air filter and throttle body. Repair slight tears with RTV silicone, but replace a slashed duct. Pull out the air filter and inspect the area where the intake air rushes in, as well as the rest of the filter. If only the small section around the air intake is coated with dirt, you may be able to tap off the excess and turn the filter around to expose a clean area to the intake.

Replace the fuel filter, too. Typically you can't see if its element is dirty, so it's cheap insurance to replace it when you change the air filter.



The fuel filter is under pressure—be careful when opening the fittings.



Checking the intake manifold mounting: Bolt torque on some engines can reduce the chance of a vacuum leak.

Exhausted

Exhaust gas recirculation valves accumulate carbon and may stick open, which can upset idle and part-throttle operation. To check the valve at idle, apply 15 in. or more of vacuum, with a manual vacuum pump or by temporarily rerouting the existing hose to a source of engine vacuum. This test can't be used on GM cars with all-electric EGR valves. If the engine stalls, that indicates the valve has opened. Next, have a helper press the gas pedal partly down and repeat the test. The engine should stumble but keep running. Disconnect the vacuum supply and the engine should smooth out instantly as the valve closes immediately and completely. If the engine doesn't respond properly, let the engine cool, unbolt the valve and wire-brush deposits from the area around the tip.

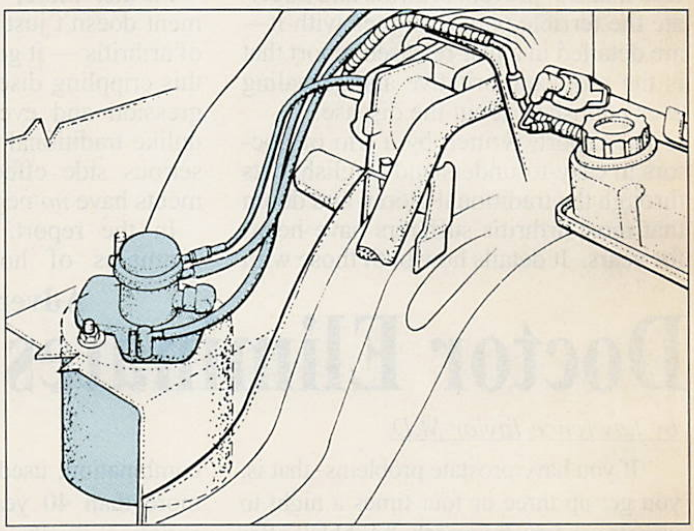
Do The Tighten Up

Check and tighten every engine electrical/electronic ground you can find. Use a manual with an electrical locator section for guidance. A bad ground can cause all kinds of driveability problems and produce several trouble codes, leading even many pros to improperly replace the powertrain computer.

Tighten the intake manifold and throttle body nuts/bolts using a torque wrench. An air leak may not only upset idle, but could produce part-throttle hesitations, because it's allowing unmetered (and unfiltered) air into the engine.

Valve Relief

More and more engines are overhead-cam "crashers," which means there's no piston-valve clearance. If it has a camshaft timing belt and it snaps, a piston rises and hits an open valve, causing expensive damage. Inspect the belt. Remove the belt upper cover and crank the engine in short bursts, while looking for deteriorated teeth or cracks in the belt sidewall. If the belt doesn't look great, which is very possible as an engine passes 50,000 miles, it should be replaced.



A leaky or malfunctioning evaporative emissions charcoal canister system can cause high pollution and poor running.

Although most engines have hydraulic lifters, many have adjustable mechanical lifters. And they typically carry a recommendation for an annual measurement of valve clearance, with adjustment if necessary. Of course, overhead-cam engines have short valvetrains, and may go a long time between adjustments. So all you need for the check is a set of feeler gauges. If an engine has shim adjustments, you'd need special tools to extract the shims, and an assortment of new shims to make corrections. Leave it to a pro. PM

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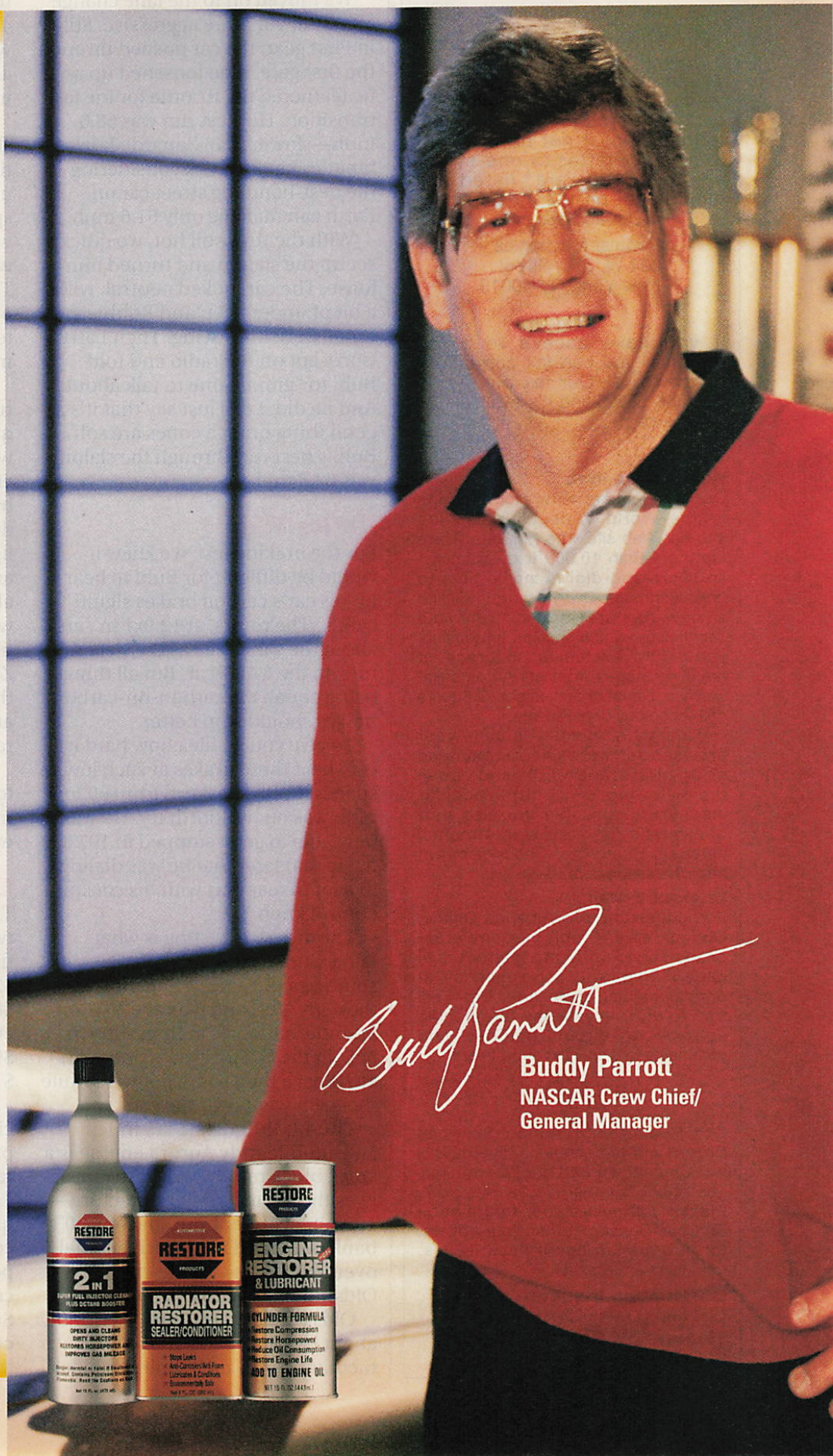

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4-wheel independent suspension with unequal-length control arms, pushrod-actuated coil-shock units and cockpit-adjustable antiroll bars front and rear. And just like the Reynard, it didn't like the bumpy surface we tested on.

We moved on to the lane change and Buhl got more aggressive. Still in First gear, the car pushed through the first gate, then loosened up as he feathered the throttle for the last transition. His best run was 68.6 mph—slower than Zanardi, but breathtakingly quick considering the best-handling street car on Earth can manage only 61.6 mph.

With the tires still hot, we quickly set up the slalom and turned him loose. The car looked neutral, with a bit of understeer, and Robbie's times were improving. Then Larry Curry got on the radio and told Buhl to "gimme one to talk about." And he did. Let's just say that it's a good thing orange cones are soft. Buhl's best run through the slalom was 62.3 mph.

Brake Time

For the braking test, we knew it would be difficult for Buhl to heat up his car's carbon brakes significantly. The rotors, at 12.9x1 in., are about the same size as the steel rotors on the CART car. But all things being equal, the carbon-on-carbon brakes should stop better.

To give you an idea how hard it is to heat these brakes at such low speeds, Buhl's best run from 60 to 0 mph was on his fourth try. He was only able to get it stopped in 107.89 ft. He said later that he was dialing in a lot of rear bias with his cockpit control knob.

The dragstrip testing is what Larry Curry was waiting for. He did some straight-line racing himself in the early '70s, and won the NHRA Summernationals in Englishtown, N.J., in the Q/Stock class one year, so he gave Buhl some pointers while the team went over the car.

The 4.0-liter (244.1 cu. in.) Oldsmobile Indy Aurora engine is a stock block motor, which means it uses the same basic architecture—102mm cylinder bore spacing, 90° bank angle and chain-driven dual overhead cams—as the engine in Oldsmobile's Aurora street car.

Olds isn't as hush-hush as Honda about its race engine. It runs on methanol, uses an aluminum block with iron cylinder liners and aluminum heads, four valves per cylinder, sequential electronic fuel injection, 15:1 compression ratio, 8.1-in. deck height and a dry sump oil system. Curry says that horsepower is 675, which is usually passed through a small 7-in. clutch to a 4-speed transmission and a rear end with a spool. The day of our testing, an experimental 5.5-in. clutch was installed—ultimately our undoing.

That spool locking up both wheels should have helped rear-wheel traction on the dragstrip. But the transmission was the handicap. The 4-speed, which is a converted 6-speed, was geared for an oval. The ratios were tall and widely spaced, with Third and Fourth being essentially overdrives. Buhl finished the quarter-mile runs in Second gear. Remember, Zanardi finished in Sixth.

On the starting line, the Olds V8 rumbled like a Super Stocker—quite a contrast to the high-pitched whine of the turbocharged CART engine. After a good, long smoky burnout, Robbie staged and dropped the clutch at the green light. The car hooked up quickly, and Robbie shifted to Second gear about 100 ft. past the tree. The time was good: 10.00 seconds at 153.01 mph. His 0-to-30-mph time, like Zanardi's, was unimpressive. But the 3.76-second 0-to-60-mph time and the 1.59-second 40-to-70-mph raised some eyebrows.

The team was excited and anxious to do even better. But that experimental clutch had other ideas. It was cooked. The day was over.

Conclusion

The biggest difference between the two cars isn't on the track. It's at the bottom line. John Menard paid $280,000 for his GForce chassis and $80,000 for the Olds Indy Aurora engine. Zanardi's race car cost $630,000, and that's without the $1.5 million engine lease.

The IRL teams, cars and—especially—the drivers are having a problem gaining the respect of the racing community and the fans. That's ridiculous. The IRL cars are quick, and they handle. Our tests confirmed that they don't quite perform up to the level of a CART car, which remains the ultimate. Surely they're close enough to be considered serious race cars. We think Ray Harroun would agree. PM

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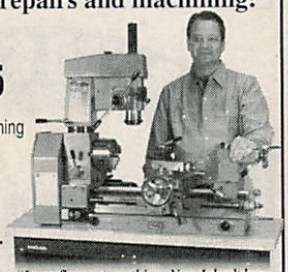

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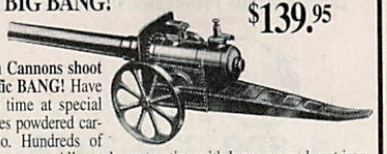

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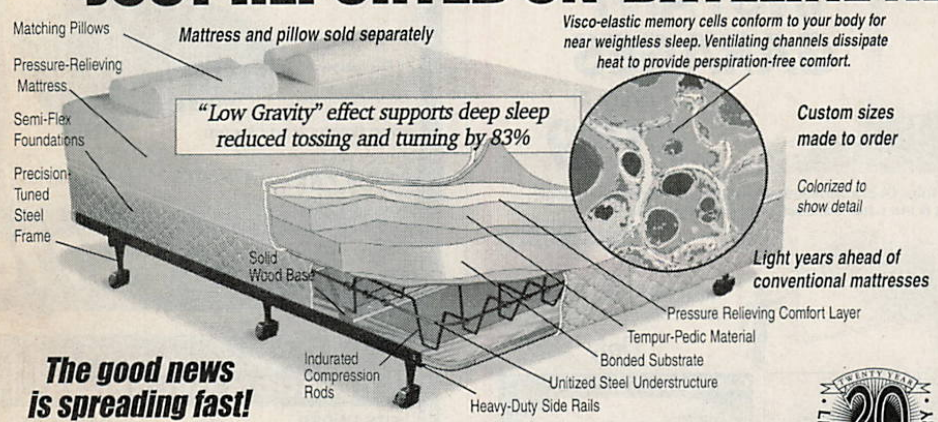
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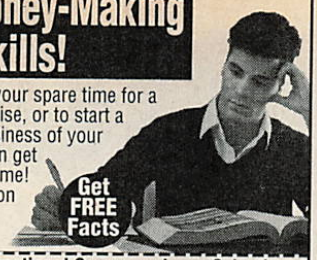

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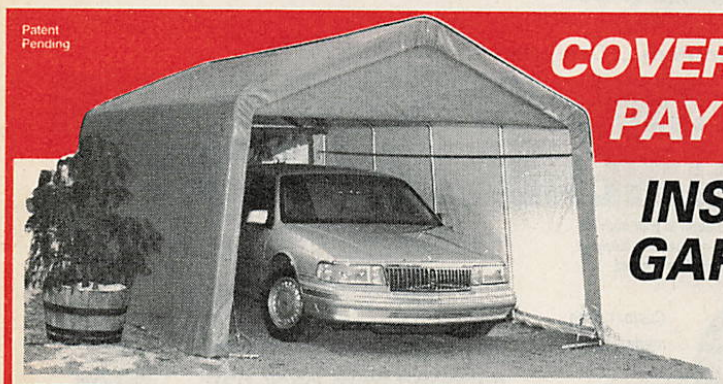

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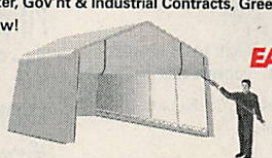

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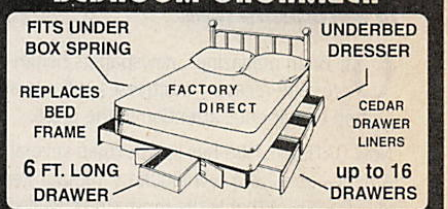

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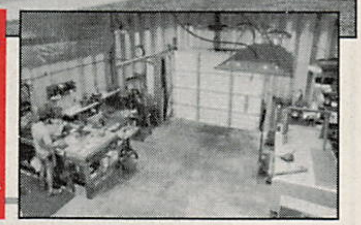

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DAVID RAYSIK, on behalf of himself and all others similarly situated, Plaintiff,	§	IN THE DISTRICT COURT
vs.	§	
QUAKER STATE - SLICK 50 INC., SLICK 50 MANAGEMENT, INC., SLICK 50 PRODUCTS CORP., and SLICK 50 CORP., Defendants.	§	DALLAS COUNTY, TEXAS
	§	68TH JUDICIAL DISTRICT

SUMMARY NOTICE OF CONDITIONAL CERTIFICATION AND PROPOSED SETTLEMENT OF CLASS ACTION AND HEARING ON PROPOSED SETTLEMENT

TO: ALL PERSONS IN THE UNITED STATES (INCLUDING ITS TERRITORIES AND POSSESSIONS) WHO, PRIOR TO SEPTEMBER 23, 1997, PURCHASED AT RETAIL FOR CONSUMER USE AND NOT FOR RESALE ANY AUTOMOTIVE ENGINE TREATMENT SOLD UNDER THE "SLICK 50" TRADEMARK.

THIS NOTICE MAY AFFECT YOUR RIGHTS. YOU ARE URGED TO READ IT CAREFULLY.

THE PURPOSE OF THIS NOTICE IS TO INFORM YOU OF: (A) THE PROPOSED SETTLEMENT OF THE CLASS ACTION REFERRED TO IN THE CAPTION OF THIS NOTICE; (B) THE HEARING TO BE HELD BY THE DISTRICT COURT FOR THE 68TH JUDICIAL DISTRICT OF TEXAS TO CONSIDER: (i) CERTIFICATION OF A SETTLEMENT CLASS; (ii) THE FAIRNESS, REASONABLENESS AND ADEQUACY OF THE PROPOSED SETTLEMENT AS TO THE SETTLEMENT CLASS; (iii) WHETHER CLASS COUNSEL HAVE ADEQUATELY REPRESENTED THE INTERESTS OF THE MEMBERS OF THE SETTLEMENT CLASS; AND (C) AN APPLICATION TO BE MADE BY THE ATTORNEYS FOR THE SETTLEMENT CLASS FOR AN AWARD OF ATTORNEYS' FEES AND EXPENSES. THIS NOTICE IS GIVEN PURSUANT TO RULE 42 OF THE TEXAS RULES OF CIVIL PROCEDURE AND THE ORDER OF THE COURT SIGNED MARCH 16, 1998.

NOTICE IS HEREBY GIVEN THAT:

1. On January 31, 1998, the parties reached a settlement of the above-captioned class action and similar class actions now pending in state courts in Texas, New York, California, and Alabama (the "Settlement"), and entered into a Class Action Settlement Agreement as to the Settlement Class (the "Settlement Agreement") settling all claims that have been or might have been asserted in the aforementioned actions arising out of or relating to the advertising or packaging of Slick 50 prior to September 23, 1997.
2. Pursuant to Order of the District Court for the 68th Judicial District of Texas (the "Court") dated March 16, 1998, this action (the "Action") was conditionally certified, for settlement purposes only, as a class action on behalf of: all persons (including the named plaintiffs in all of the above mentioned Class Actions) in the United States, its possessions and territories (including the District of Columbia), who purchased at retail prior to September 23, 1997, any automotive engine treatment sold under the "Slick 50" trademark.
3. Pursuant to the Order of the Court dated March 16, 1998, and pursuant to Rule 42(e) of the Texas Rules of Civil Procedure, a hearing (the "Settlement Fairness Hearing") will be held at 9:30 a.m. on July 13, 1998 (the "Hearing Date") in the Courtroom of the District Court for the 68th Judicial District, Geo. L. Allen, Sr. Building, 600 Commerce Street, Dallas, Texas 75202, for the purpose of determining whether: (a) the Settlement Class should be certified pursuant to Rules 42(a) and (b)(4), Tex. R. Civ. P.; (b) the proposed settlement on the terms and conditions provided for in the Settlement Agreement is fair, reasonable and adequate and should be approved by the Court; (c) Class Counsel have adequately represented the interests of Settlement Class Members; and (d) an Order of Final Approval and Judgment should be entered thereon; and (e) Class Counsel's application for an award of attorneys' fees should be granted. The Hearing may be adjourned by the Court from time to time without any further notice.
4. Under the proposed Settlement and for the benefit of each Settlement Class Member, Defendants agree to make available, on the terms and conditions set forth in the Settlement Agreement, the following financial benefits to or on behalf of each Settlement Class Member.
   a. Except as otherwise provided with respect to multiple purchases of Slick 50, each Settlement Class Member shall be entitled to receive one rebate form entitling that Settlement Class Member to a cash rebate of up to fifteen dollars ($15.00) payable upon the purchase, after the Effective Date of the Settlement, of products and/or services that qualify for such rebates (each a "Qualifying Product"), provided that such Settlement Class Member: (i) satisfies all applicable qualification requirements and timely submits a valid proof of claim form (except as is otherwise provided with respect to Identified Settlement Class Members); and (ii) timely submits a valid rebate form with the required proof of purchase of a Qualifying Product, in accordance with the procedures outlined in the Settlement Agreement and Notice of Proposed Settlement.
   b. Settlement Class Members who have made multiple purchases of Slick 50 prior to September 23, 1997, shall be entitled to one fifteen dollar ($15.00) rebate form for each such purchase, provided that the Settlement Class Member submits Proof of Purchase with the proof of claim form, for each purchase of Slick 50 for which a rebate form is sought. For example, if a Settlement Class Member made two purchases of Slick 50 prior to September 23, 1997, proof of both purchases must be submitted for the Settlement Class Member to be eligible for a rebate form for each such prior purchase of Slick 50. Settlement Class Members seeking a rebate form for only one such prior purchase of Slick 50 shall not be required to submit proof of that purchase.
5. To the extent that the total aggregate value of rebate forms made available to qualifying Settlement Class Members pursuant to Sections 4(a) and (b) above is less than twenty million dollars ($20,000,000), Defendants shall, through a supplemental rebate offer, make available to Settlement Class Members additional proof of claim and rebate forms in an aggregate amount sufficient to reach a $20,000,000 minimum amount of rebate forms made available. The supplemental rebate offer will entitle Settlement Class Members to a cash rebate (the "Secondary Rebate") redeemable upon the purchase of specified products, provided that such Settlement Class Member satisfies all applicable qualification requirements, and timely submits a valid rebate form with the required proof of purchase of a product for which such Secondary Rebates are available, in accordance with the procedures outlined in the Settlement Agreement. Secondary Rebates shall be available to all Settlement Class Members, including those who submitted proofs of claim or rebate forms, or received cash rebates pursuant to the initial rebate offer.
6. Any person may seek to be excluded from the Settlement Class and the Settlement provided for by this Agreement by submitting a written request for exclusion. Any request for exclusion must be filed with the Clerk of the 68th Judicial District Court, Geo. L. Allen Sr. Bldg. -- 3d Floor, 600 Commerce Street, Dallas, TX 75202 (with copies sent to Settlement Class Counsel and Counsel for the Defendants at the addresses below) no later than June 25, 1998. Any Settlement Class Member so excluded shall not be bound by the terms of the Agreement, nor entitled to any of its benefits, and will not be bound by any final judgment or other order of the Court entered herein, whether pursuant to this Agreement or otherwise.
7. If you are a member of the Settlement Class (and have not exercised your right to exclusion), you are entitled to participate in and/or to object or to be heard at the Settlement Fairness Hearing in connection with the Court's consideration of any matter relating to the foregoing Settlement, including whether: (a) the Settlement Class should be certified pursuant to Rules 42(a) and (b)(4), Tex. R. Civ. P.; (b) the proposed settlement on the terms and conditions provided for in the Settlement Agreement is fair, reasonable and adequate and should be approved by the Court; (c) Class Counsel have adequately represented the interests of Settlement Class Members; (d) an Order of Final Approval and Judgment should be entered thereon; and (e) Class Counsel's application for an award of attorneys' fees and reimbursement of costs and expenses, including expert and advisors' fees, to be paid by Defendants in an amount not to exceed $3,250,000 should be granted. A more detailed Notice of Conditional Class Certification, Proposed Settlement of Class Action and Hearing on Proposed Settlement contains a more detailed discussion of the terms of the Settlement and the procedure you must follow in order to be heard at the Settlement Fairness Hearing.

THE ABOVE IS ONLY A SUMMARY OF THE PROPOSED SETTLEMENT, ALL OF WHICH IS DISCUSSED MORE FULLY IN A MORE DETAILED NOTICE OF SETTLEMENT. THE PROPOSED SETTLEMENT, YOUR RIGHT TO PARTICIPATE IN THESE PROCEEDINGS, AND THE MEANS BY WHICH YOU MAY EXCLUDE YOURSELF FROM THE SETTLEMENT CLASS ARE MORE FULLY DESCRIBED IN THAT NOTICE OF SETTLEMENT. IF YOU ARE A MEMBER OF THE SETTLEMENT CLASS AND DESIRE ADDITIONAL INFORMATION OR THE MORE DETAILED PRINTED NOTICE OF SETTLEMENT, YOU MAY OBTAIN A COPY BY CALLING 1-800-315-5521 AND ASKING FOR A COPY TO BE MAILED TO YOU. IN ADDITION, THE MORE DETAILED NOTICE OF SETTLEMENT IS AVAILABLE FOR DOWNLOADING FROM AN INTERNET WEBSITE LOCATED AT http://206.121.104.2/3349-1/. YOU MAY ALSO OBTAIN A COPY BY WRITING TO OR CONTACTING SETTLEMENT CLASS COUNSEL AT EITHER OF THE FOLLOWING ADDRESS(ES):

COUNSEL FOR THE CLASS:

Seth R. Lesser, Esq.
Bernstein Litowitz Berger & Grossmann LLP
1285 Avenue of the Americas
New York, New York 10019
(212) 554-1400

Michael C. Spencer, Esq.
Milberg Weiss Bershad Hynes & Lerach LLP
One Pennsylvania Plaza
New York, New York 10019
(212) 594-5300

COUNSEL FOR DEFENDANTS:

Irving Scher, Esq.
Weil, Gotshal & Manges LLP
767 Fifth Avenue
New York, NY 10153

ALL QUESTIONS RELATING TO THE PROPOSED SETTLEMENT SHOULD BE DIRECTED TO COUNSEL FOR THE SETTLEMENT CLASS IDENTIFIED ABOVE OR BY CALLING 1-800-315-5521. PLEASE DO NOT CONTACT THE COURT OR THE CLERK'S OFFICE DIRECTLY FOR INFORMATION. THE CLERK'S OFFICE IS NOT PERMITTED TO GIVE LEGAL ADVICE.

Dated: March 16, 1998

By Order of the District Court for the 68th Judicial District (Dallas County).

The Honorable Gary Hall
District Court Judge

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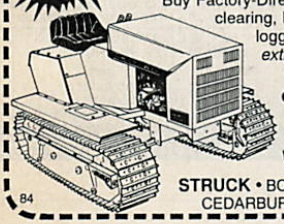

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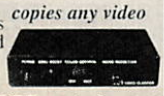

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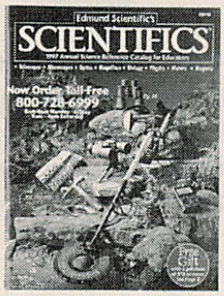

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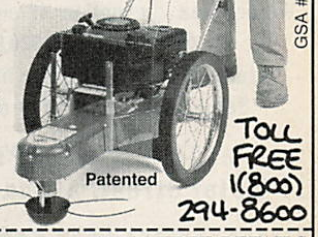

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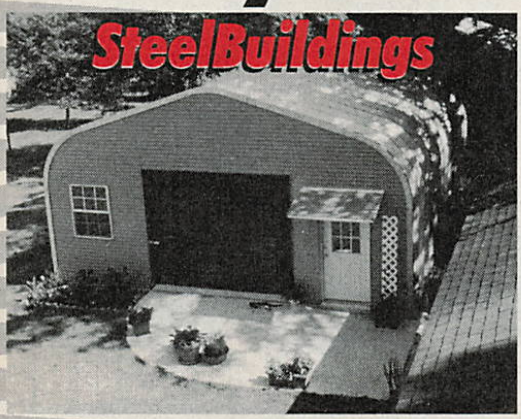

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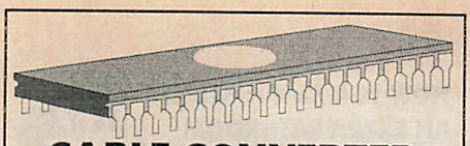

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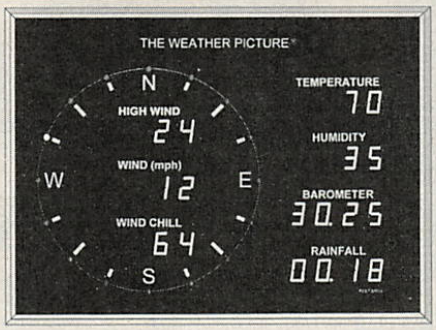

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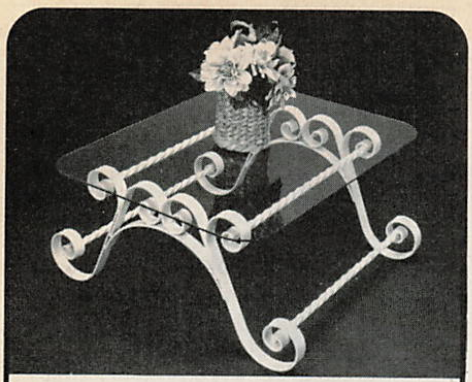

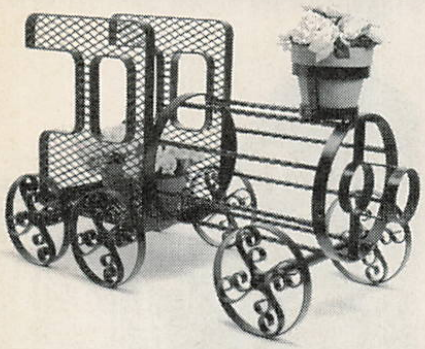

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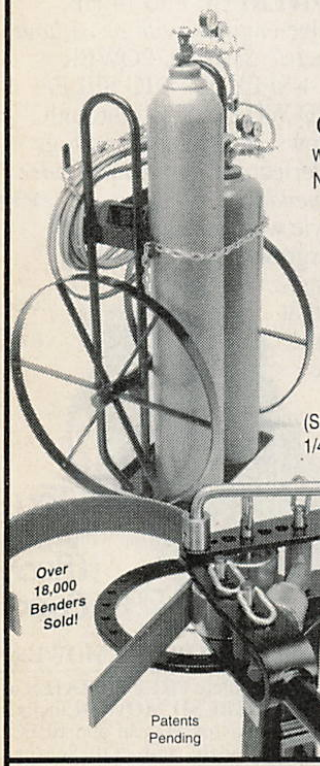

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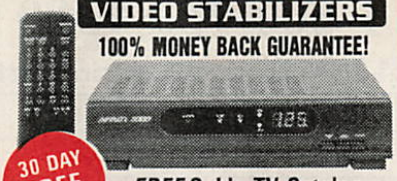

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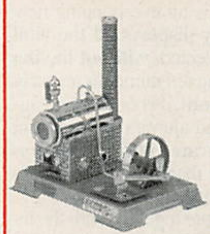

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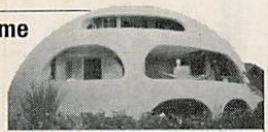

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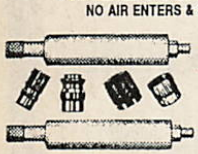

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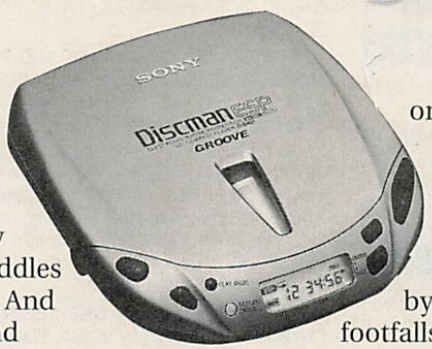
Last Page

Think It's New? Think Again!

BY MARY SEELHORST

PRESENT

Sony Discman provides personal pocket-sized music on the run from compact discs.



Taking your music with you is a time-honored tradition. For do-it-yourself types, harmonicas and jaw harps fit in your pocket, and fiddles and flutes aren't hard to carry. And then there is always singing and whistling. But Sony did them all one better.

The Sony Walkman personal stereo tape player made a big splash in 1979, and was soon updated with a radio tuner. Banking on that success, Sony followed it in 1982 with the Watchman, a tiny TV. And almost as soon as CDs hit the streets in 1983, Sony was there with the Discman, a flat, palm-sized one-banger CD player perfect for picnics, car trips or just walking around.

Almost as quickly, innovators began improving the tiny portable player's shock protection to guard against those annoying skips caused by bumpy roads and heavy footfalls. But consumers didn't seem to mind occasional skips—or the high price of the new discs. By 1986 CDs outpaced vinyl LPs in sales. The dominance of the CD is so complete that kids who see a gold album award invariably say, "Look, Mom, a big CD!"

The portable CD player allowed us to take music to places where no man had ever taken music before. Or did it?

PAST

Compact phonograph fit in your pocketbook and would unfold to play 10-in. records.

Platter In Your Purse

Ever since Mr. Edison laid down the first groove in 1877, innovators have fast-forwarded the technology toward portability. No matter what the medium—phonograph, wire recorder, tape, compact disc—manufacturers always believed that small machines meant big sales.

A tiny article in August 1926 introduced a big concept: "Phonograph That Fits In Handbag." About the size of today's Sony Discman when closed, it would play up to a 10-in. record. Of course, you couldn't hook it to your belt, but it was "perfect for picnics and camping trips" according to POPULAR MECHANICS.

Stylishly nickel-plated, the mini-phonograph unfolded to reveal a tiny turntable, complete with speed regulator, tone control and a small speaker. No word from PM on whether headphones were included.

But if you think that's all there is to this story, think again. My research has uncovered an astounding and disturbing relationship between miniature electronics and the tobacco industry, surely worthy of further study funded by a very large government grant—or possibly even a lawsuit.

In 1926, the manufacturer of the miniature phonograph featured in PM emphasized the small size of the unit by comparing it to something the public was familiar with—a tobacco pouch. In the 1980s, Sony compared the small size of some of *its* products to something the public was familiar with—a cigarette pack. **PM**

PHONOGRAPH THAT FITS IN HANDBAG

Music for picnics and camping trips is supplied by a midget phonograph that fits the pocket or a handbag and yet plays records up to ten inches in diameter. Features of the compact outfit are a speed and tone regulator and a special sound box. The phonograph folds into a round nickel case about the size of a tobacco pouch.

Phonograph Packed, and Below, Ready for Playing; It Takes Ten-Inch Records or Less

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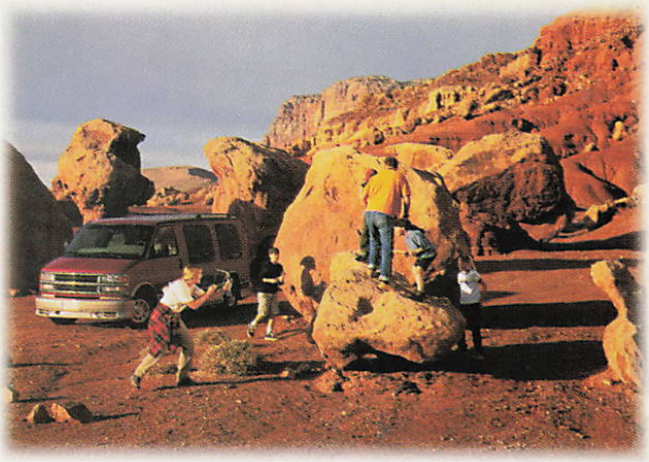

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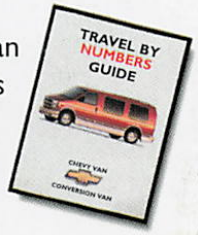

You'll learn how to make the most out of your trip with a Chevy Van® Conversion Van because it's the fun way for the family to travel. And before conversion, Chevy Van gets the best available highway mileage of any full-size van.* Chevy Van from Chevy™ Trucks – the most dependable, longest-lasting trucks on the road.†

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www.chevrolet.com Shown with conversion package from an independent supplier. See the owner's manual for information on alterations and warranties. *Mileage comparison based on Chevy Van Cargo Van and comparable competitive products prior to any alterations. EPA-est. MPG city 15/hwy. 20 with available Vortec 5000 V8. Excludes other GM products. †Dependability based on longevity: 1981-1996 full-line light-duty truck company registrations. Excludes other GM divisions. ©1998 GM Corp. Buckle up, America!